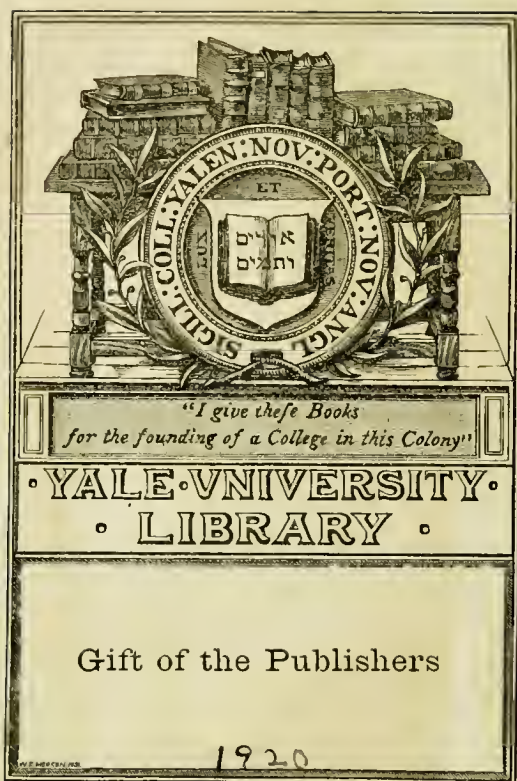


**The Sortation Theory
of
Vaccination**

By
Eugene Bettes, M. D.



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Proving Vaccination
A Failure

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Eugene Bettes, M. D.



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THE SORTATION THEORY OF VACCINATION

(PROVING VACCINATION A FAILURE)

CHAPTER I.

Introductory.

This treatise is an elaboration of a part of a prize thesis on vaccination submitted in the spring of 1877 to the Medical Faculty of the Columbian, now the George Washington University. As the thesis took the ground that vaccination neither protected from smallpox nor mitigated the disease in the slightest degree the honor it received, coming as it did from a strictly orthodox faculty, has probably remained unique. Presumably, therefore, the paper had something of merit. With equal certainty, at least, we may assume that the faculty was liberal in its judgments, inclined to practise what it preached and in accordance with this sentiment: "Inquiry into the evidence of doctrine is not to be made once for all, and then taken as finally settled. It is never lawful to stifle a doubt; for either it can be honestly answered by means of the inquiry already made, or else it proves that the inquiry was not complete."

The thesis contained three matters to which I wish to refer. First: In it I broached what I termed the Test Theory. In this essay I have substituted Sortation for Test, the word being described in the dictionaries as rare, and defined as "the act or process of sorting." Second: I predicted that medical science while accepting as true the greater portion of the alleged facts commonly offered in support of the mitigation theory, would ultimately put upon them a widely different interpretation. Third: Referring to the tendency of the superintendents of smallpox hospitals to publish the number of their vaccinated and of their unvaccinated patients, with the deaths in each class, under the belief that they were demonstrating the mitigating power of vaccination, I stated:

"They are building wiser than they know, and are more apt to erect a structure that will fall and crush them than to further their designs."

I consider both of these predictions largely fulfilled. At the time I wrote only two of the groups of primaries that I have utilized in Chapter v. were in existence, and only that taken from Mr. Ballard's work was known to me. It was therefore impracticable to apply the concomitant variation test to an extent that would exclude the error of small numbers, though possible to anticipate the result of later inquiries and to remember that all things come to him who waits.

The Issue.

Of all the varied claims made in behalf of vaccination there is but one that secures universal acceptance even among the advocates of the practice; this is that vaccination mitigates attacks of smallpox. All do not believe that it protects in any degree, although that it does is the almost unanimous claim. There is a wide diversity of opinion in regard to the number of scars that should be secured. You can find alleged experts favoring one or ten or any intermediate number. Some attach great importance to foveation, while others think the poor scar from this point of view is equally as good if not better. Whether revaccination is ever necessary, and if so how frequently it should be performed, are unsettled questions. Starting with the assumption that the protection lasted for the entire life, a possible one hundred years, the speculative duration of the protection has progressively dwindled until there are now parties who advocate bi-annual vaccination for the general public and others who favor a monthly repetition of the rite for those liable to come in contact with the disease. Most of its advocates affirm that vaccinia or cow-pox is a variolous disease; but a number, estimated at one time as a large majority, assert that it is just the reverse, an anti-variolous disease.

More than a century of observation and experience has passed. The operation has been performed more than a billion of times. Unlimited opportunities for study have existed among black, white, yellow, red and brown races in all ages and classes and all seasons and conditions. The funds and legal forces of all civilized and most semicivilized nations have been at the beck and call of the vaccinators. In some cases for a century. Monkeys, horses, calves, caribou, sheep, goats, gazelles and other animals as well as humanity have been experimented with without limit; yet not the slightest progress has been made among vaccinators towards the settlement of any of the disputed questions.

Amidst this diversity of opinion on all other related topics there is absolute unanimity among cow-pox champions that vaccination mitigates smallpox in a wonderful manner. The anti-vaccinationists, properly so-called, assert with equal unanimity that the rite is always an injury of some degree and never a benefit in any degree. If, therefore, there is merit in the injunction "Strike at the knot" the mitigation dogma calls for the chief attention. This work will be devoted to that topic, no attention being paid to the question of protection, except incidentally.

Apart from personal testimonies of little value the proffered evidences of mitigation are statistical data. These show that when cases of smallpox are divided by hospital physicians favorable to the rite, into vaccinated and unvaccinated, the former have the lower fatality, the larger proportion of discrete and of varioloid cases, a shorter average duration of the disease and presumably a greater exemption from severe sequelae, such as deforming scars and blindness. This much is conceded. Further it is granted that these results, though in a less marked degree, are obtained when the classification is made by an opponent of vaccination and is therefore not open to a suspicion of professional bias. It is also conceded, though it is proper that I should here disavow any representative character, that the benign features of the smallpox are in general emphasized when the preceding vaccine disease has been "genuine," or the resulting scar "good," when the vaccina-

tion has been "recent" or the scars are "multiple," using the quoted words, of course as vaccinators use them. The claim made here is that these statistics simply show the existence of a causal relation, and that though multiplied a hundredfold and shown to be as ubiquitous as man it would not increase in any degree their evidential value. This means that the two bodies are unlike to an extent sufficient to cause the statistical differences observed. It is here claimed that the dissimilarity is due primarily to unconscious sortation, reinforced, however, by a varied assortment of helping manipulations. It is the purpose of this volume to show in convincing detail the presence of these two factors and their sufficiency to account in full for the causal relationship shown to exist by pro-vaccinal statistics.

In writing this treatise I have kept constantly in mind that if one wishes to oust a faith he must depend upon the strength of his own philosophy and not on the weakness of that he wishes to subvert. Accordingly I have been very explicit in detailing the modus of vaccinal sortation and very full in supplying the corroborating facts. Even at the risk of many possibly unnecessary repetitions I have very frequently called attention to the fact that the existence of the corroborant might have been logically inferred or predicted as a necessary corollary of the sortation theory. In this respect the mitigation theory is a distinct failure. Most of the phenomena relied upon by the advocates of vaccination to support their main contention are just the reverse of what we should on a priori grounds expect. Thus smallpox after vaccination is in theory recurrent smallpox and should be severe instead of mild. If proper virus is used and systemic infection secured when vaccinating, the course of the disease can have no bearing on the amount or the presence of immunity. The fact that multiple scars are associated with mild smallpox is not properly an argument for vaccination but the reverse. This also is true of the statistics supposed to show the greater value of scars of a certain type. These matters, however, will be considered more fully elsewhere.

The Problem and Its Solution.

Somewhere in flotsamic literature a celebrated mathematician is represented as saying that if he had a given problem to solve in two minutes and his life depended upon its successful solution in that time, he would devote the first minute to getting a clear understanding of the problem and of the best method of effecting a solution. Although but few controversialists follow this plan, all will admit that it is the one best adapted to the making of converts and the furtherance of truth, the sole legitimate aims of polemical or of expository writings.

With the issue clearly stated the problem before us is easily understood. It is simply which of two theories, the mitigation or the sortation best explains and makes intelligible the conceded facts gathered almost exclusively by the advocates of the older theory. For the solution of this problem we shall adopt the common sense or scientific method as outlined by Tyndall.

“Laying the theoretic conception at the root of matters we determine by rigid deductions what are the phenomena which must by necessity grow out of this root. If the phenomena thus deduced agree with those of the actual world it is a presumption in favor of the theory. If as new classes of phenomena arise they also are found to harmonize with the theoretic deduction the presumption becomes still stronger. If finally the theory confers prophetic vision upon the investigator, enabling him to predict the existence of phenomena which have never yet been seen and if those predictions are found on trial to be rigidly correct the presumption of the truth of the theory becomes overwhelming.”

Mitigation Theory.

The cow is subject to smallpox but has the disease in such a modified form that it is not contagious and is never fatal. The disease can be transferred to humans by inoculation, retaining the non-fatal and non-contagious features that are present in the cow. The inoculated or vaccinated person is in the same

condition as regards future smallpox as a person who has survived an attack of that disease, except that the immunity is of a fugitive character and of uncertain and variable duration. When the immunity has partially faded out there may be a failure to protect from smallpox, but in that case the disease will be mild. Such is the claim. In reality there has never been a single undisputed allegation of fact and inference either historical, pathological or statistical offered in support of this theory. This applies equally to the claim that cow-pox is a form of smallpox and the cow-pox or vaccinia makes a person immune to smallpox. The theory is a mythical explanation of a mythical condition. Smallpox in man is a contagious constitutional disease. It attacks both sexes and all ages and the eruption appears in all parts of the body. Cow-pox is a purely local disease and is treated successfully by caustics. It attacks but one sex and the eruption is confined to the teats and udder. It has its origin in the distended and inflamed breasts of a bovine mother with her first born. It affords no immunity against itself.

The Jennerian explanation why cow-pox prevents smallpox belongs to the same class as Pomet's explanation why the hoof of the left hind foot of the elk, worn as a ring or necklace prevents epilepsy. "Of all parts of this animal there is none used in medicine but the left hind foot," "because he is very subject to the falling sickness and as soon as he is attacked with this disease he fails not to put his left foot to his left ear to cure himself thereof."

Another author tells us that in Scandinavia this preventive was obtained by beating an elk over the head with a club. The particular hoof that contained the valued agent was determined by its wiggle woggles or convulsive movements. Very silly you think. Yet the falling sickness produced in the elk by clubbing is as nearly related to human epilepsy as the pustules on the shaved abdomen of a tortured calf are to smallpox.

Sortation Theory:

According to this theory the vaccinated and the unvaccinated

are radically unlike bodies, sufficiently unlike to account for any actually existing differences in their fatalities. Vaccination is a rational skin reaction test by which it can be determined with a fair degree of accuracy, for a few years following the application of the test, whether a person if attacked by smallpox will have the disease in a mild or a severe form. The purpose of the smallpox inflammation is to localize a germ invasion by building around the nidus a fibrinous wall and then to extrude through the skin or mucous membrane the semi-encapsuled germs and the battle debris. The vaccine inflammation has the same purpose. The germs are very slightly if at all pathogenic but are sufficiently irritant to cause the desired reaction. Mild vaccinia therefore means mild smallpox. Genuine as applied to vaccinia is an imposter term for mild or regular. Jenner's so-called discovery was simply this; the healing of a little wound intentionally produced has the same prognostic significance as that of a little wound accidentally produced. Jenner never knew what he had discovered; neither do his followers; nor, as a rule, do they care.

Deductions and Predictions.

The first step in the proper testing of a theory is to determine upon the phenomena that should be capable of demonstration if the theory is well founded but which should not be present if the theory is unsound. Some of the deductions made, and sought to be demonstrated in these pages are: 1. The net fatality or deaths per one hundred cases of smallpox should remain unaffected by variations in the per cent. vaccinated. It should be the same whether all or none, whether 20, 40, 60 or 80 per cent. are vaccinated, provided of course, that the contrasted groups are alike except as to vaccination. 2. The fatality of the vaccinated should increase as the per cent. vaccinated increases until all are vaccinated, when the fatality of this class should equal that of the partially or that of the wholly unvaccinated groups. 3. The fatality of the unvaccinated should increase as the per cent. vaccinated increases, the refuse character of this class increasing as their num-

bers diminish. There is no limit to the fatality of this class except 100 per cent. 4. The apparent saving of lives by vaccination as shown by the difference between the fatalities of the vaccinated and of the unvaccinated should increase as the per cent. vaccinated increases because the fatality of the unvaccinated increases faster than that of the vaccinated. 5. The number of varioloid cases should be unaffected by variations in the per cent. vaccinated except to a very limited extent due to biased classification. 6. The above statement should hold true of discrete smallpox and also of confluent smallpox. 7. The characteristic features of any type of vaccinia found to be markedly associated with mild smallpox should be found to be rational indications of good health. 8. The characteristic features of the good scar should be indications of good health. 9. The apparent benefit of multiple scars should be limited to countries where there is much variation in the number of scars produced by the different practitioners. This makes selection possible. 10. Increased resort to multiple scars should be followed by increase in the fatality of those with such scars. Many other deductions, statistical, historical and pathological could be made and tested but the foregoing are sufficient for the present purpose. They are here enumerated as illustrating a method of inquiry. The method has been termed geological because of its similarity to testing by boring at different points.

The Revolt.

In all progressive countries there is a great and steadily increasing opposition to vaccination. In this country necessarily the evidences of this revolt are scattered. But we are told by advocates of the rite that Boston is a "hotbed" of the opposition and that in West Virginia "intense prejudice exists in all parts of the state." Utah in 1907 passed over the governor's veto a law prohibiting any form of compulsory vaccination and in 1908 the parents of Omaha kept 1,000 children out of school for four months and thus compelled the Common Council to rescind its brutal regulation. Records of a similar character are made throughout the country.

It is to England, however, where the registering apparatus is more nearly perfect that we turn for our most instructive facts. On the 1st of January, 1908, after the people of England had been beneficiaries of the "greatest civil gift of God to man" for 110 years, a law went into effect by which any parent could exempt himself from punishment for not having his child vaccinated by sending in to the proper authority before the child was four months old a statutory declaration that he conscientiously believed the operation would be injurious to the child. The first year there were 163,000 declarations filed. The average annual increase over the preceding year has been about 28,000. In the six years, 1908-1913, the declarations were 1,417,000. The last year of the term the declarations equalled 35 per cent. of the births, and about 11 per cent. of the children escaped by less formal methods. Making a slight allowance for the deaths occurring in early infancy it is clear that in 1914, of the children that reached the age of six months, more than one-half went forth to meet the demon of smallpox without the benefit of the scar amulet. The indications are that with all indirect compulsion withdrawn the number of persons who patronize vaccinators will about equal those who patronize other dealers in the occult. In 1912, out of 54 counties in the country, 18 showed a vaccinal abstention ranging from 50 to 83 per cent. of the births, and thirteen counties showed an abstention of between 40 and 50 per cent. Two or more counties annually move from the second into the first class.

In 1872 the Prudential Life Assurance Company gave notice that a certificate of vaccination would no longer be required. This was a break-away. By 1910 there were 23 other companies including the Mutual Life of N. Y., that had followed suit. Presumably there are more now, but the matter has ceased to be of interest. The National Board of Education has wholly abrogated the requirement for teachers, the assigned reason being a paucity of teachers. The right of conscientious objection has been given to nearly the entire civil service. The National Insurance law prohibits the doctors from using any powers accruing under the act to

enforce vaccination.

It is no longer possible to prevent bona fide inquiry. If vaccination has the merit ascribed to it then England is in for some great epidemic of smallpox. There must be a great increase in cases and deaths. The net fatality should rise until it equals that of the unvaccinated in the past. The increase should be most marked in the towns and counties that have shown the greatest vaccinal abstention. Children in the first five years of life should be the greatest sufferers; then those a little older. The house incidence must increase, for that solitary unvaccinated child in a large family that the germ so hunted, is of the past. The life assurance companies will repent or go bankrupt. The Civil Service records will show that its employees have been committing suicide by the aid of smallpox.

None of these horrors has yet made its appearance though in Keighly the revolt dates back to 1876 and in Leicester to 1885 and in other towns a score or more of years. This means a steady growth of opposition to vaccination.

Though the revolt has been most effective in English speaking countries, it has made great progress in Germany. In 1911 the Reichstag was petitioned for the right of conscientious objection. Practically no notice was taken of the request but in April 1914, similar petitions with the consequent motions were debated for two days and the motion to refer the matter to an evenly balanced bi-partisan committee was lost by a vote of 119 to 119, the speaker voting no. The passage of the needed law cannot be long delayed.

Of the twenty-five Swiss cantons three never had compulsory vaccination. Commencing in 1876, by 1895 nine cantons had repealed their compulsory laws. The free cantons contain 78 per cent. of the country's population. In 1882 an attempt was made to head off the repealing movement by the passing of a national law. The stratification in belief displayed is very instructive. Of 1,168 physicians replying to a circular from headquarters 1,122 or 96 per

cent. favored the law. The Federal Council passed the bill by a vote of 90 to 23 or 80 per cent. By referendum the law was rejected by a vote of 254,340 to 68,027 or 79 per cent. As regards smallpox the free cantons fare the best. Of the Latin countries, France and Italy lead in the revolt.

CHAPTER II.

Who Are the Unvaccinated?

The composition of this body has varied greatly at different times and at different places, but always it has contained an undue proportion of certain classes having a high fatality in smallpox and in other diseases. The most notable of these classes is the very young, and next probably, the sickly. Then we have three classes of the constructively unvaccinated—the so-called insusceptibles; parties whose vaccine scars are wholly hidden by the smallpox pustules; parties whose scars are atypical in appearance either as the result of poor physical condition or as the result of the disturbing effects of severe smallpox. I have dealt with the unvaccinated only as they affect the question of mitigation. If it had been my object to show the large number erroneously called unvaccinated the classes would have been considerably increased. For instance, Dr. Welch of Philadelphia, rated as vaccinated only those who had visible scars on their arms while admitting that there were “many” who claimed to have been vaccinated on other parts of the body.¹ As there is no reason to suppose that persons that prefer to be vaccinated on the leg are bad risks, they are not included in my list though well entitled to consideration in any study of the attack rate.

The Very Young.

Until babies are vaccinated in the hour of their birth, infants and young children will necessarily form a large proportion of the unvaccinated in all communities where vaccination is customary or obligatory. In England, parents or guardians were for many years required to have their children or wards vaccinated at three months of age. In 1898 the age limit was raised to six months. In Scotland the age is six months, in Ireland three months or as soon thereafter as may be practicable. The present German law requires that the vaccination be performed during the year following the calendar year in which the child was born. This makes the

average exemption period about eighteen months. Though the rite is legally compulsory in some of our states at an early age it is rarely enforced until school age, and then only by the penalty of exclusion from school. In some of the smaller continental countries also, notably Holland, children are exempt until school age. But no matter at what age vaccination is made compulsory or becomes general by usage an age class with a high fatality is necessarily left unvaccinated.

The natural effect of this exemption on fatality statistics is made obvious by Dr. William Pepper's remark: "The greatest susceptibility to the variolous poison seems to be during the first two years of life at which time the form of the disease is very apt to be confluent and in a large proportion of cases fatal."²

A German authority states: "As regards age, infants almost always die when attacked by variola on account of the interference with nursing, while older vigorous children often survive severe attacks."³

A recent English writer says the disease is fatal in "nearly all children under one year whatever form the disease may assume."⁴

The celebrated French authority Trousseau is thus quoted: "Confluent variola and even discrete variola are almost always fatal in individuals less than two years old."⁵

In minor epidemics the high fatality of the unvaccinated is sometimes wholly due to the fact that one or more of the decedents were infants.

In Oakland, California, in 1888, there was a slight epidemic of smallpox. Omitting the cases occurring among the Chinese who had probably been inoculated and in one white who had also been inoculated, the result was as follows: Number of cases 13, vaccinated 12, unvaccinated 1; deaths, vaccinated 1 or 8.5 per cent., unvaccinated 1 or 100 per cent. The unvaccinated case was an infant four and a half months old. With the seven cases occurring among the Chinese there was a total of 21 cases with four deaths or 19 per cent. Twenty cases or 95 cent. had been protected by vacci-

nation or inoculation; yet their death-rate was that of England before Jenner.

Smallpox appeared in the town of Carpi, Italy, in August 1899, and lasted until the end of the following January. There were 109 cases, of which 106 had been successfully vaccinated. Of the three not vaccinated two were too young for the operation. One of the three died, a baby of three months, making an unvaccinated fatality of 33 per cent. of the 106 vaccinated cases 10 died or 9 per cent.⁶ The figures are from official reports.

A good illustration is given by Dr. Heinrich Oidtman. It is based on the official report of the smallpox epidemic of 1871-72 in the village of Lovenich, circle of Erkelenz, Prussia. The report gives the death-rate of the vaccinated as 18 per cent. and of the unvaccinated as 100 per cent. There were seven cases of the disease in children under fourteen months of age. Four were unvaccinated and three vaccinated. They all died and if the comparison had been made between children of that age no evidence of mitigation would have been present. But all attacked above that age were vaccinated. There were 75 of these with 11 deaths. This makes 14 deaths in 78 cases, a fatality of 18 per cent.

The Winnipeg, Manitoba hospital closed July 1902. "It had been occupied almost continuously since last October and of all the patients treated only one death occurred, an infant one week old," presumably unvaccinated, though in this report it was not so stated.

In the larger epidemics young children form an important part, and where the statistics are reliable, a very important part of the unvaccinated. During the epidemic of 1871, there occurred in Bavaria, probably at that time the best protected country in the world, 790 unvaccinated deaths and of these 743 or 94 per cent. were infants under one year of age. In this case the facts were to a great extent obtained from the parents, and the constructively unvaccinated were almost completely eliminated.

The Sickly.

This is a small but very important class. Unhealthy or deli-

cate children are apt to have bad arms as a result of vaccination and consequently they are to a great extent exempted from the operation. Dr. Moffett, referring to a wholesale vaccination of school children at the City Dispensary, Indianapolis, remarks: "Only some fifty were unduly severe. The precaution was taken to vaccinate no children suffering from scrofulous skin diseases, etc., whereby doubtless many severe cases were avoided."⁷ The effect of exempting scrofulous children from vaccination is seen in Gregory's remark: "In the strumous habit the sequelae of smallpox are peculiarly severe and often threaten the loss of life when the first dangers have been passed."⁸

In Germany where vaccination is very nearly universal the unvaccinated are a very refuse class. In Berlin in 1898 there were 686 postponed vaccinations; for scrofula 357, scrofula and rachitis 86, atrophy 100, tuberculosis 52, syphilis 3 and epilepsy 2.⁹ Now add to these the children that are too young to be vaccinated and you have a pretty fair answer to the query: "Who are the unvaccinated?", and also a fair explanation of the very high unvaccinated fatality.

Hidden Scars.

The variolous eruption does not appear by chance. The elective points are those that have been injured or weakened in some manner. Places that have been subjected to the pressure of garters or belts, that have been recently scratched or bruised, the sites of past blisters, scars, eczematous or psoriatic patches and parts that have been much exposed to the air as the face and hands attract pustulation.

As a result the site of vaccination is apt to be invaded by the smallpox pustules, and the more recent the vaccination the greater the chance of obscuration partial or total of the scars. Thus an individual who may have had in health six or even more visible vaccine scars will, after the variolous eruption has made its complete appearance, show on examination five, four, three or two scars or no scar, according to the severity of the disease.

The vaccinators as a rule avail themselves of this peculiarity and by refusing to count as vaccinated any who do not present visible vaccine scars they are enabled to throw many of the fatal cases occurring among the vaccinated into the unvaccinated column or alternatively into a class called "doubtful" or "Said to be vaccinated but without visible marks." In the Gloucester, England epidemic of 1896 there were 40 cases of alleged vaccination but with no vaccine scars visible. The fatality of this group was 57 per cent. Of these Dr. Coupland reports: "The profuseness of the rash, concealing the sites of vaccination, accounts for the rather large proportion of the 'alleged vaccination class.'"¹⁰ This is practically an admission that they were all vaccinated. Dr. Savill reports as to the Warrington epidemic: "In nearly all fatal cases the eruption is profuse and tends to hide the vaccination scars if they exist."¹¹ It should be borne in mind that these parties were unwilling witnesses. They were confronted with the necessity of admitting that the vaccine scars were hidden when the eruption was profuse or else that the statistics in these towns as well as elsewhere were deliberately falsified.

Insusceptibles.

If a person is vaccinated by a competent party using virus that proves effective in other cases, and after three trials there is no inflammatory result such person is in theory immune to smallpox. There is no fact basis for this theory but it is very convenient because persons showing this peculiarity can be classed as vaccinated as long as they remain free from smallpox and as unvaccinated when they contract the disease.

A few years ago Dr. Stanton of Philadelphia, died of smallpox. He had been vaccinated twenty-four times without success, yet if he was sent to the Municipal Hospital, as he presumably was, he was classed as unvaccinated because he had no visible marks on his arm. In Washington in 1895, Mrs. Maggie Pember-ton was vaccinated three times without success, adjudged an immune and employed as a nurse in the smallpox hospital where

she promptly became a patient and added to the death roll of the unvaccinated.

We are told by a Boston physician that: "The fact that physicians and nurses who have been constantly exposed to the contagion and in two instances under my own observation have been inoculated with the virus upon abrasions of the hand while they showed no trace of a vaccine cicatrix yet have not suffered from the disease, is certainly strong evidence that vaccination may protect without any external mark whatever."¹²

We are not told, however, the fact that if any one of these doctors or nurses had contracted smallpox he would have been treated in the same hospital and classed as unvaccinated.

' In the Marine Hospital at Baltimore during the 1871-73 epidemic, Dr. Summerfield observed "many instances in which the disease attacked persons who had been repeatedly vaccinated without success." This means that in "many instances" patients were improperly classed as unvaccinated.

Vaccinia and Other Diseases.

If the vaccinated and the unvaccinated are unlike bodies then disease other than smallpox should affect these bodies in an unlike manner. Diseases that are relatively severe in infants and young children should be severe in the unvaccinated while those that are chiefly fatal to adults should furnish evidence, if we reason after the manner of vaccinators, that vaccination increases their fatality. The following testimonies include all statistical statements that I have met with on the subject of this section:

Measles. "Joler has described an epidemic of measles that took place in the Retzat Circle in Bavaria in the district where he himself resided. He says that the disease was much milder among the vaccinated than among the unvaccinated; 15 in 52 died among the non-vaccinated while barely one in three hundred died among the vaccinated; showing that measles was 86 times more fatal among the former than among the latter."¹³

There was no demand for this class of facts. Even if its full import was not seen it was evident that it proved too much. The supply ceased. Vaccinators repudiated Joler's claim that vaccinia mitigated measles; but failed to give any explanation of the apparent mitigation. We cannot blame them. It is no easy task to dispose of Joler without injury to Jenner. Did not faith stand in the way the matter would be simple enough.

An eminent German authority states: "The rule may be laid down that measles is essentially dangerous only for young or very young children; that its dangers decrease rapidly with accession of years; and in the late years of childhood it is already at a minimum."¹⁴ We need no statistics to show that in a community "protected" to the Bavarian extent measles would be very fatal among the unvaccinated.

The only other study of the relation of measles to vaccination that I am aware of was made by Dr. Welch. Statistically the results were; cases 23, vaccinated 22, unvaccinated 1, deaths in unvaccinated 1 or 100 per cent. and deaths in vaccinated 1 or 4.55 per cent. Dr. Welch regards this result as curious, but does not feel called upon to explain, though if we substituted the term variola for measles he would undoubtedly regard it as a proof that vaccination acts as a mitigant and that anyone that did not concur in that deduction was "an enemy of society and should be dealt with as such."

In a later paper Dr. Welch gives his hospital experience for twenty years. This paper follows quite closely the lines of his Report except that it is silent on the matter we are now considering though the cases available for study had probably doubled.

Debauch, etc. Besides the twenty-three cases of measles sent erroneously to the hospital Dr. Welch had twenty-one scattered cases of disease received in the same manner. The list reads; debauch 4, catarrh 3, itch 2, and one each of the following: abortion, cerebro-spinal meningitis, debility, pneumonia, pleurisy, rheumatism, scarlatina, typhus fever, typhoid fever, varicella, erysipelas and diarrhoea. Nineteen were protected, of whom one

died, a case of scarlatina at two years of age; per cent. 5.26. Two were unprotected of whom one died; per cent. 50. A mother died on her way to the hospital of smallpox and her unvaccinated baby died the same day of debility. Taking the cases of measles and the scattering together we get these figures. Whole number of cases 44, deaths 4, per cent. 9; protected cases 41, deaths 2, per cent. 5; unprotected cases 3, deaths 2, per cent. 67. Separate these results from the context and you could not tell them from the most marvelous returns from smallpox hospitals, given out to the public in the interest of the vaccine contention; and yet there was not a case of smallpox among them.

Typhus Fever. "Dr. Perrin, a prominent physician, says that the influence of vaccination on mortality was proved in 1854 in France. He mentions 114 cases of typhus. Of these 76 were vaccinated and of them 35 died; of the other 38 not vaccinated only three died." ¹⁵

The above is quoted from an early and sensational anti-vaccination pamphlet. No reference is given and no verification has been made. Presumably the figures are correct; at least there is no reason why we should doubt their correctness. In typhus fever the proportion of deaths is "in striking relation to the advance of life. Thus, while in children under fifteen, the death rate is only 5 per cent. in persons over fifty it is about 46 per cent." ¹⁶ The low fatality from typhus fever in the very young is remarkable. An Irish physician states: "It is a well known fact that typhus fever is scarcely fatal at all to children. I never saw a young child die of typhus fever and I have seen thousands of cases." ¹⁷

Consumption. From another opponent of vaccination we learn that "Of 208 children that had been vaccinated 138 died of tubercular consumption and 65 of other maladies; in 95 who were not vaccinated 30 only died of tubercular consumption and 65 of other diseases." ¹⁸ This is mainly a matter of age though vaccination may have a slightly injurious effect.

The statistics just quoted or perhaps some other of similar

import stimulated Dr. Quain to secure a refutation. He found, says Ballard "as a result of a special inquiry in respect to phthisis that thirty per cent. or more of the patients in a public hospital suffering from that disease showed no marks of vaccination whatever."¹⁹ Ballard continues, "Such an observation as this tells powerfully in favor of vaccination since the proportion of unvaccinated persons to the whole community in London which avail themselves of eleemosynary institutions is, judging by the number of unvaccinated children in public schools, not much above six per cent." How the fact that the consumptives in a London hospital contained about five times as many unvaccinated as we ought on a *priori* ground to have expected tells powerfully in favor of vaccination is not clear unless it is claimed that vaccination prevents consumption. Neither Ballard nor Quain makes this claim. But if vaccination does not prevent consumption how could Quain appear to show statistically that it did prevent. Simply because the sickly, delicate children of the present, the oftentimes consumptive of the future were often left unvaccinated.

Diseases in general. Leonhard Voigt, Director of Vaccination in Hamburg, investigated the claim that the three weeks following vaccination are weeks of exceptional danger, and found as he thought "that the exact reverse is the case, namely, that those weeks constitute a period in which the death-rate from such diseases as bronchitis, pneumonia, diphtheria, measles, scarlatina, cholera, convulsions, brain inflammations and diarrhoea falls to one-seventh to one-twentieth of that to be expected from the known mortality for the given ages."²⁰ Obviously then there was a correlation between good health and vaccination. An English observer tested the claim that vaccination is injurious. Between January 1st, 1900 and July 1st, 1902 he had under observation 987 children for the first year of life or until death, less the first month, when none were vaccinated. Of these 706 or 72 per cent. were vaccinated. Among them there were 60 deaths or 8.49 per cent. Of the 281 unvaccinated 45 died or 16.01 per cent. In explanation of this great difference we are told "that the prac-

tioner is extremely discriminating and does not vaccinate the weaklings; that is, those likely to die within a year."²¹ On the other hand two-thirds of the unvaccinated were the children of conscientious objectors who obtained their certificates of exemption." "I have often observed that these extremists were of a neurotic type." "There is a nervous tension in their ethical code that bespeaks instability and lowered vitality, their children die not from want of care and nutrition but by inherent constitutional defects." "At first these parents had their children vaccinated; the death of the first born was erroneously attributed to the operation and thereafter their children were deprived of this great blessing." "This tradition passes from mother to daughter and still their children die probably in the same proportion."

It is said of sailors visiting certain tropical islands that they pelt the monkeys in the treetops with worthless sticks and stones in order to get pelted back with the desired cocoanuts. The refutatory efforts of Doctors Quain, Voigt and Mackenzie, just quoted, indicate that there may be profit in making worthless or greatly exaggerated charges against parties controlling the output of desired facts.

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CHAPTER III.

Historical Examination of Smallpox Fatalities. American Civil Experience.

Boston—Our information as to the fatality of smallpox in this country prior to vaccination is derived from Boston records for a period of eighty years, and one epidemic in Charleston. Except for their restriction to one locality the Boston statistics are the most satisfactory that the 18th century furnished. The facts were obtained, except as to one epidemic where the number of cases was to have been "partly estimated," by what was termed a "scrutiny" made after the cessation of the different epidemics. The conduct of the scrutiny of 1721 is thus detailed by Douglas. "Aeneas Salter, employed by the Select Men of Boston (the prudential managers of town affairs) to make a scrutiny after the smallpox had ceased, by a book in several columns of lists, he found that the number of persons that continued in Boston (many fled into the country), were 10,567 whereof about 700 escaped; the smallpox decumbents had been 5,989 whereof 844 died which is nearly one in seven."

There was no bias present to cause any understatement as to the fatality of the disease. If there were any misstatements they were in an opposite direction, as is shown by the testimony of Franklin. Of the epidemic of 1752 he writes: "As the practice of inoculation always divided people into parties, some contending warmly for it, and others as strongly against it, the latter asserting that the advantages pretended were imaginary and that the surgeons from views of interest concealed or diminished the true number of deaths occasioned by inoculation and magnified the number of those who died of the smallpox in the common way; it was resolved by the magistrates of the town to cause a strict and impartial inquiry to be made by the constables of each ward who were to give in their returns upon oath, and that the inquiry might be made more strictly and impartially some of the

partisans for and against the practice were joined as assistants to the officers and accompanied them in their progress through the town from house to house. Their several returns being received and summed up together the numbers turned out as follows.”

The figures given differ slightly from those in the table below. This also is true of the figures by Douglas. Franklin appears to have depended in part at least, upon his memory, as he places the epidemic at “about 1753 or 54.”

Eighteenth Century Smallpox in Boston.

TABLE I.

Years	Natural and Inoculated		Natural Smallpox		Inoculated Smallpox	
	Cases	Deaths	Cases	Deaths	Cases	Deaths
1721-----	6,006	850	5,759	844	247	6
1730-----	4,000	500	3,600	488	400	12
1752-----	7,669	569	5,545	539	2,124	30
1764-----	5,646	170	669	124	4,977	46
1776-----	5,292	57	304	29	4,988	18
1778-----	2,243	61	122	42	2,121	29
1792-----	8,346	198	232	33	8,114	165

In the seven epidemics covered in the table there were 16,231 cases of smallpox with 2,099 deaths, a fatality of 12.93 per cent. If we omit the epidemic of 1730 when the returns were partly estimated, the fatality falls to 12.75. In the epidemic of 1752 with its bi-partisan scrutiny the fatality was 9.72 per cent., the lowest in the series except that of 1776 when the fatality was 9.5 per cent. The war period epidemic of 1778 gave a fatality of 34.32 per cent., the highest of all. It also furnished the smallest number of cases and it is fairly probable that under the exceptional conditions present the cases were not well reported.

There seems to be no ground for doubting the ability of the doctors to diagnose smallpox correctly during the period in question. Of earlier epidemics Douglas says: “Hitherto petechial purple spots and hemorrhages of which many died were called mortal scarlet fever invading the town at the same time with the smallpox, but an entirely distinct distemper. 1721 I was the first who in New England introduced them as deleterious symp-

toms in smallpox." Of this epidemic he states: "About 81 died with purple and hemorrhages which is about one in ten of the deaths." Of the 500 deaths in 1730 we are told "about 75 with purple and hemorrhages." It is quite clear that the low fatality was not due to the exclusion of severe cases.

Commencing with 1872 we have in many of our large cities an accurate annual statement of the cases and deaths of smallpox. In Boston for the thirty-nine years 1872 to 1910 inclusive there were 5,631 cases with 1,365 deaths, a fatality of 24.24 per cent. A very large proportion of these cases were admittedly vaccinated, yet the death-rate was nearly double that present when there were no "modified cases."

Charleston.—With the exception of Boston this is the only American locality that furnishes any information relevant to our inquiry. In Boston, smallpox whether inoculated or contracted by contagion was more fatal in the Blacks than in the Whites. Douglas believing this to be a matter of climate writes: "In hot countries it is more fatal in Whites than in Blacks. In Charles Town of South Carolina, when the smallpox prevailed 1738, upon a scrutiny it was found that in the natural way, of 647 Whites died 157, is one in four, by inoculation of 156 Whites died 9, is one in twenty. Of 1,024 Blacks in the natural way there died 138, is one in seven and a half, of 251 Blacks by inoculation there died seven, is one in thirty-six." The fatalities are: Whites 24.27 per cent., Blacks 13.48 per cent. Both races together 17.65 per cent.

Douglas was not an advocate of inoculation and was more inclined to figures than to sensational stories; but Dr. Ramsay, of Charleston, a warm advocate of inoculation, writing more than a half century after the event thus describes the epidemic: "In the year 1738 it was imported in a Guinea ship and spread so extensively that there was not a sufficiency of well persons to attend the sick and many perished from neglect and want. There was scarcely a house in which there had not been one or more deaths." Of the epidemic of 1760 he writes: "Inoculation was resolved upon and became general. Fifteen hundred persons are said to have

been inoculated in one day; but it is also said that 500 of these died. This mortality though great was comparatively less than what had taken place in the year 1738." ⁴ According to Douglas the fatality of the inoculated was less than 4 per cent, while Ramsay makes it one-third of the whole number and nearly three times as fatal as the natural disease in Boston. The public are now fed with stories like this to show the fearful ravages of smallpox before Jenner.

The only available 19th century data relating to Charleston that I have found is a report of the Smallpox Hospital for Refugees and Freedmen from May 1, 1866 to July 1, 1866.⁵ Total cases 522, deaths 109, fatality 20.88 per cent. This is higher than the fatality of the blacks in the prevaccinal epidemic although nearly 48 per cent. of the patients were admittedly vaccinated.

United States Navy.

The only prevaccinal statement bearing on our topic that I have been able to find is a foot note in a book published in 1802 referring to an epidemic on the frigate *Constellation*. It reads: "I was informed by her commander, Captain Murray, that in her last cruise one hundred of the crew had the smallpox, five or six of whom died." ⁶ Dr. Coxe, from whom I have quoted, was writing in favor of vaccination and gives the above-mentioned fact as evidence of its necessity. He makes no comment on the death-rate and we may fairly infer that neither he nor Captain Murray saw any reason to regard it as exceptional.

In the 21 years, 1850-1870 inclusive, there were in the navy 1,481 cases of smallpox with 135 deaths, a fatality of 9.12 per cent. But a fatality of 6 per cent. in a body of men of whom not one had been vaccinated, and a fatality of 9.12 per cent. in a body of men of whom all had been vaccinated, or otherwise protected, and many revaccinated is suggestive of error as well as destructive to the claims of vaccination. Turning back to the records⁷ of the 21 years referred to we find that there were fourteen outbreaks that might be termed epidemic with cases ranging from 12 to

116 in number. The average fatality in these epidemics was 8.6 per cent., showing that the sporadic cases had a higher fatality, or perhaps were not so well reported. We ought therefore to compare Captain Murray's experience with a recent epidemic of similar extent. On board the *Independence* in 1850 there were 116 cases with 7 deaths, a death-rate not distinguishable from that which occurred a half century earlier when none of the cases were "modified." Surgeon Whelan in his report states: "The crew of the ship almost universally presented what are regarded as genuine vaccine marks. The protection, however, proved to be quite imperfect."

In the 16 years 1880-1895 there were 95 cases with 5 deaths and for the 11 years 1895-1905 inclusive, a Naval Inspector states: "The type varied greatly, but it cannot be considered as having been very mild as the mortality was about 14.3 per cent."⁸ There is here no evidence of mitigation.

United States Army.

During the War of the Revolution there was but little of the natural smallpox, but a great deal of the inoculated disease, and nothing is known of the fatality of the former. Dr. Benjamin Rush wrote long after the war, in which he participated, quite a full account of the "Diseases which occurred in the Military Hospitals of the United States during the Revolutionary War," but he makes no mention of smallpox.

For the War of 1812-15 the returns are admittedly incomplete. "The distempers were dysenteries, fluxes, tertian, quartan and anomalous fevers, obstructions in the viscera, swelled feet, dyspnoea," etc.⁹ Measles was also somewhat prevalent. Smallpox is not mentioned nor is there any reference to vaccination.

There is an official report of sickness and of the deaths in the army during the 20 years 1819-39. Out of a total of 86,565 cases of disease tabulated, no case of smallpox appears. Returns for 20 years 1840-59 show 134 cases with 15 deaths, or 11.19 per cent., the

aggregate strength being 1,187,144. This includes the Mexican War period.¹⁰

Now the scene changes. Up to this time recruits had been vaccinated at the time of enlistment only, if at all. At the outbreak of the Civil War the vaccine delusion had about reached its height. Field vaccination was now in order. Dr. Martin of Boston, with assistants, went to the front and saved the Army of the Potomac. Other surgeons saved the remaining troops. Wherever these parties went smallpox promptly disappeared, so they said. They could not be present at all times at all places; so the final record runs: White troops May 1, 1861, to June 30, 1866: Cases of smallpox 12,236, deaths 4,717, per cent. 38.35. Colored troops July 1, 1863, to June 30, 1866; Cases of smallpox 6,716, deaths 2,341, per cent. 34.38. Total for White and Colored troops: Cases 18,952, deaths 7,058, per cent. 37.24.

Owing to the blockade the Confederates were unable to get good virus and had to resort to makeshifts of various kinds. Total cases of smallpox during the war period 9,830, deaths 2,624, per cent. 26.69.

Then came great alleged improvements. It was discovered that vaccine virus that passed from arm to arm gradually lost its potency and back to the cow was the road to salvation. A savior appeared in the form of a sick calf in Beaugency, France. Dr. Martin imported some of the virus and commenced the calf-to-calf process of manufacture. The business was profitable and other sick bovines were found by rivals and our soldiers now got the genuine virus in its pristine strength. They were in a condition, so it was taught, to laugh at smallpox. The advantages of the improved virus were shown in the Philippine War. Cases of smallpox 674, deaths 249, per cent. 36.94. In the Mexican War the proportion of deaths from smallpox to deaths from all diseases was 1 in 427, in the Civil War 1 in 26 and in the Philippines 1 in 11. The fatalities were 11.37 and 37 per cent., respectively, and vaccination was improving all the time.

British Civil Experience.

Upon the introduction of inoculation into England the opponents of the practice claimed that it caused as many deaths as would occur if similarly selected healthy persons, properly prepared had the disease in the natural way as a result of the older practice of intentional exposure to the infection. To meet this objection Dr. Jurin¹¹ undertook to keep an account for a sufficient term of years, of all the cases of inoculation that he could learn about with the results, and to publish the same annually with an account of inquiries as to the fatality of the natural smallpox. We are here only concerned with the last inquiry. Jurin was a believer in inoculation and there is no reason to suppose that he or any of the parties that aided in the work had any disposition to understate the fatality of the natural disease. If there was any bias present it would work in the opposite direction.

In his first letter he gave a total of 4,626 cases with 856 deaths. This was in 1723. Up to and including 1726 the cases of the disease collected by Jurin amounted to 18,089 with 2,957 deaths, or 16.35 per cent. These accounts were taken by careful persons by exact inquiries from house to house in different years and different seasons of the year and in different places to ascertain the number of cases and deaths in the preceding year. Jurin considered his figures large enough for a reliable average and abandoned his self-imposed task. He was followed by Dr. Scheuchzer, who carried the account along for two years, bringing the total cases to 18,229 with 3,008 deaths or 16.50 per cent. Some later but scattered observations gave a slightly higher rate and the general opinion was that the fatality of smallpox was somewhere between one in five and one in six.

Black, writing in 1781, referring to the above opinion, says: "This is the general measure of many years mortality and is the result of later and more enlarged calculations" than those of Jurin.¹²

Writing not more than a year before the appearance of Jen-

ner, Willan states: "From the report published by the committee of the Smallpox and Inoculation Hospital it appears that of those who take the disease casually the mortality is in the proportion of one to six."¹³

When Jenner's claim for a reward was considered in 1802 by a Parliamentary Committee, Dr. James Sims, President of the London Medical Society, gave one in six as the fatality. In 1812, when a further award was granted, the committee stated in the report: "The loss in the natural smallpox is probably not less than one in six." Jenner's biographer, writing a hundred years later than Jurin, referring to prevaccinal times, says: "Of persons of all ages taken of smallpox in the natural way one in five or six died." Gregory, writing in 1843, after telling of the higher fatality in the hospital, adds: "We may state the average mortality by smallpox at one in six. Now this is exactly the calculation made by Dr. Adams thirty-five years ago when he said that smallpox occasioned very nearly a double decimation."¹⁴

Adams was in charge of the London hospital for years and was followed by Gregory. They had great experience and were free from any bias in the matter and were justly regarded as authorities. I have amplified testimonies here possibly to an unnecessary, but certainly not to an exhaustive extent, because I wish the reader to correctly appraise the experts who will be cited in the next chapter. These experts, when asked for an explanation of the increased fatality among the unvaccinated and the steadiness of the total fatality, replied: "I have not considered the point." "I have not data with regard to prevaccination times." "I could not tell you anything about prevaccination times." Evidently they were not trying to answer valid objections to their propaganda, but simply to find simulation of valid evidence that would mystify the credulous.

British Navy.

But little is known of either the attack or the fatality rate of smallpox in the English Navy during the 18th or earlier centuries.

Walker, writing in 1790, states that he had at an earlier period, an opportunity of witnessing an outbreak of smallpox at sea, when every man liable to the disease took the infection. He claims that if the rules of prevention had been as well understood at that time as when he wrote, and applied to the first case¹⁵ "many would have been preserved from a severe disease with bad accommodations and the deaths of four or five good seamen prevented." Many cases with four or five deaths is somewhat vague, but does not convey the impression of the great fatality that is alleged to have prevailed before Jenner. There is nothing here to indicate a higher fatality than we have at present. A more definite statement is made by Blane, who writes: "The smallpox prevailed more at this time in the fleet than I have ever known it to do either before or since and that both in the squadron from England and in that from North America."¹⁶

The epidemic referred to occurred in the fleet investing our Atlantic coast in 1782, some seventeen years before the publication of the remark quoted, and, as Blane says, it was the greatest prevalence he had ever known either before or since with his wide experience as fleet surgeon and surgeon general we may infer it to have been as severe as any occurring in the English Navy during the last twenty-five years preceding vaccination. The complement of men was 11,797. In February there were six deaths from smallpox; the number of cases is not stated. In March there were 49 cases with 5 deaths, a fatality of about 10 per cent. Thereafter although monthly statements of the deaths in the fleet are given there is no reference to smallpox.

An earlier authority illustrating the fact that the disease would sometimes die out without attacking all of the susceptible, remarks: "Thus although the infection of the smallpox was pent up entirely in the Royal George among eight hundred and eighty men yet the contagion disappeared altogether at sea several months before the ship put into any harbor after having destroyed four or five persons and left near one hundred unattacked."¹⁷ The fatality does not appear to have been frightful. The only other

writer who can be classed as prevaccinal giving any information as to the fatality of smallpox is Fleet Surgeon Trotter. He had his work in course of publication when vaccination was announced. In the first volume he gives no cases nor tells of any epidemics of smallpox. In the second volume after he had become an enthusiastic vaccinator he gathered all the reports that he could find in the entire navy for 1798, a year when the disease was quite prevalent. The force was very large, about 120,000 seamen. From ten or more infected vessels he collected 42 cases with 14 deaths, a fatality of one-third. The cases, however, are mostly sporadic and it is probable the deaths were better reported than the cases. There is good reason to believe that non-fatal cases were frequently reported under the general title of "eruptive diseases." There are quite a number of prevaccinal writers on diseases in armies and navies whose works are accessible. Some do not mention smallpox at all and none refers to it as a disease of any importance. In the testimony of Staff Surgeon Theodore N. Preston, R. N., before the Royal Commission the following appears :

"Q. 2664. Can you give us any information as to the amount of smallpox in the navy prior to the introduction of vaccination?— If I may be allowed I would quote a passage from a work by Sir Gilbert Blane entitled 'On the Value and Present State of Vaccination' which was written in the year 1819. He says: 'When there was no vaccination in our navy one-fifth of all the men enlisted died of smallpox.' It seems incredible that any medical man could hear this story without smiling, yet it was promptly repeated in this country for the instruction of the American Medical Association. How often have we been assured that prior to vaccination persons over fifteen years of age rarely had smallpox, as they all had it when younger. In the year mentioned Blane published a volume¹⁸ containing the essay referred to, but neither in this paper nor in any other written by him is there any statement that bears any resemblance to the quoted remark. The myth basis is evidently a statement made by Blane in a different essay but published in the same volume as that mentioned by Surgeon Preston that in

his private practice in London from 1795 to 1806, inclusive, he had 15 cases of smallpox. Three, or one-fifth of these, proved fatal. In a city where smallpox is now alleged to have been constantly present and to have affected all classes indiscriminately, Sir Gilbert's cases of smallpox were in the proportion of 1 to 254 of all cases of disease treated and the deaths from smallpox were 1 in 127 from all causes. This is the sole basis for the statement that one-fifth of all sailors in the English Navy prior to vaccination died of smallpox, and it is not a phenomenal exaggeration either.

Surgeon Preston further testified, but this time without giving his authority, that "In the prevaccination times in the service whenever a case of smallpox arose it was always confluent." Sir Gilbert asserts, however, that on the *Formidable*, his own vessel, in 1782, four cases of six were distinct.

Referring to cases on board the *Queen Charlotte*, Dr. Trotter says: "The smallpox were chiefly of the distinct sort and only one died, a boy."¹⁹ Probably there were about the same proportion of distinct cases as at present, approximately two-thirds. Sailors are now more carefully selected than in the 18th century. The press gang is a thing of the past.

Passing to the vaccination era we have for the Royal Navy of England statistics furnished to the Royal Commission for the 29 years 1860-88. During the first fifteen there were four changes in the vaccination regulations. The practice was officially recommended in 1860, made obligatory upon new entries in 1864. Revaccination was enforced after 1871 and a body of foreigners formerly exempt from compulsion were brought under the rules in 1873. After that there were no changes for the reason that all the theoretic requirements had been carried out to the utmost limit. There was a marked falling off in the number of cases, from 2,449 in the 15 years 1860-74 to 214 in the 14 years 1875-88, but the fatality which also should have been favorably affected rose from 7.55 in the first period to 14.44 in the second period. Surgeon Preston, who brought the data before the Commission, was silent as to this last feature as he was as to the possibility that

the lowered attack rate might be due to improved isolative and other sanitary measures on shipboard and on shore leave. In the 37 years 1872-1908 there were in the navy 574 cases of smallpox with 62 deaths or 10.80 per cent., a fatality higher than that which prevailed before the four extensions of vaccination noted.

In 1795, three years before Jenner's *Inquiry*, the British Admiralty commenced the issue of lemon juice to the navy as a preventive of scurvy. It proved very beneficial though not an equivalent to a full supply of fresh vegetables. Two years later came the mutiny at Spithead and the Nore. The ringleaders were hung, but the rations were greatly improved and in various ways the sanitary conditions have been progressively improved.

In 1797 there died of all causes in the navy one in eight of the crew annually. In 1811 one in thirty-two died and in 1836 one in seventy-two. This great fall in the mortality, a fall of eight-ninths in forty years, has always been attributed to the two great causes mentioned above. If English sailors at the present time show more recoveries from smallpox than in the 18th century their better health conditions furnish an adequate explanation. Of course other navies have shared in this movement, and the decline in the general death-rate, disease being always the principal factor, has continued up to the present, though necessarily at a diminished rate.

British Army.

There are several works now extant written by English doctors before the time of Jenner, dealing with diseases of armies. With one exception they make no reference to smallpox or pass it by with trifling notice. Munro,²⁰ the exception, referring to a camp in England, says: "Seventy-six had the smallpox this season (1799). Of these, 24 had the distinct kind, 40 the confluent and 3 petechial. All those with the distinct kind recovered; 11 of those with the confluent died." The three petechial cases all died. This is a fatality of 18.43 per cent.. The low fatality in the confluent cases, 22.45 per cent., suggests that some pretty mild cases were classed as confluent.

Munro also gives the details of an outbreak of smallpox among the English soldiers in Germany in 1761-63. The total cases were either 35 or 36. One camp reported either "6 or 7 cases." There were six deaths, one being "a child." If we include the child and take the minimum number of cases the fatality is 17.14 per cent. If we exclude the child and take the maximum of the remaining cases the fatality falls to 14.3 per cent. The report states: "There was nothing particular in the course or in the treatment of the disease differing from what we meet with in daily practice."

Germany.

The German prevaccinal smallpox statistics are of little worth for the reason that varicella or chickenpox was considered a mild form of smallpox and was so classed. This belief persisted up to a comparatively recent date. Shortly before the resort to vaccination a well-known author published a *Catechism of Health*.²¹ It contained the following: "Is great mortality occasioned by the smallpox? Yes, in general out of ten patients laboring under the smallpox one dies." This calculation is probably too low. Statistics for some scattered visitations, possibly selected for their exceptional severity and freedom from chickenpox, show a much higher rate. The history of the work referred to presents an interesting feature that perhaps justifies a little wandering. The author claimed that isolation was the proper and sufficient method of combatting smallpox. Owing to the belief that chickenpox was smallpox, supposed recurrent smallpox was very common and the German physicians did not take kindly to variolous inoculation. They thought that if the natural disease had so little immunizing power the inoculated variety had not enough to compensate for its dangers. This made them friendly to isolation and Faust's work ran through several editions. But when the work was to be published in England it was found necessary to strike out every word in the body of the work commending isolation in order to secure the desired medical endorsement. This expurgated translation was issued in this country with the advertised approval of a number of prominent physicians.

In the German Empire from 1896 to 1908, inclusive, there were 3,101 cases of the disease with 428 deaths or 13.80 per cent. There were no imperial records of the cases prior to 1896. Though the Germans are supposed to be the most vaccinated people in the world their fatality is no lower than that of the other European nationalities.

France.

For this country we have facts that should secure confidence. Daniel Bernouilli, a celebrated French mathematician and physician of the 18th century, placed the fatality of smallpox at one-eighth to one-seventh.²² There were no higher estimates. If we suppose the prevaccinal fatality to have been just midway between one in seven and one in eight the percentage would be 13.39 while the just quoted modern German experience gives 13.80 per cent. In France in the eleven years 1875-1885 with a large percentage vaccinated there were 134,894 cases of smallpox with 22,102 deaths or 16.5 per cent. If we go back to 1844 when but few were vaccinated we get cases 8,112, deaths 1,175 or 14.47 per cent. In 1860-71 with 1870 missing there were 411,442 cases with 82,591 deaths. This gives a fatality of 20.1 per cent. The cases and deaths among the soldiers are not included.

Switzerland.

Tissot, whose widely known treatise on Health was translated into English and published in 1722, writes: "It must be acknowledged at the same time to be one of the most destructive distempers, for if in some years or seasons it proves to be of a very mild and gentle kind, in others it is almost as fatal as the plague. It being demonstrated by calculating the consequences of its most raging and its greatest prevalence that it kills one-seventh part of the number it attacks."²³ This is all the testimony we have for the Land of Tell appertaining to the 18th century. Recent statistics are not numerous but in Canton Zurich 1876-1888 there were 944 cases of smallpox with 156 deaths or 16.5 per cent. In the Canton of Berne in 1881 there were 293 cases with 54 deaths or

18.4 per cent. The proportion vaccinated is not known but it must have been large.

Ceylon.

Just prior to the introduction of vaccination this island experienced a severe visitation of smallpox. We are told that "from the 1st of October, 1800, to the 30th of September, 1802, the number of patients with natural smallpox treated by the medical overseers in the different hospitals and villages in Ceylon was 2,110, of which number 473 died, being nearly one-fourth of the whole." There is nothing known as to the extent or severity of preceding epidemics.

Before the complete dying out of the disease vaccination was resorted to on a very limited scale and the disappearance of the epidemic was attributed to this then novel rite.

The claim that vaccination had exterminated smallpox was maintained up to 1819. In July of that year the disease became severely epidemic. There was a second epidemic in 1830, a third in 1833 and a fourth in 1836. In these four epidemics there were 12,557 cases with 4,090 deaths. On the average they were about 50 per cent. worse, as regards both the spread and the severity of the disease, than the epidemic that Christie cited to show the ravages of smallpox among an unvaccinated population. The proportion vaccinated among the patients is unknown except that in the last epidemic, of 460 cases 341 represented themselves as vaccinated. It was explained, however, that the operators were paid so much for each case and they had collected pay for hundreds and thousands of vaccinations that were never performed.

I take the following extracts from the Travel Notes of an ardent vaccinator as late as 1904:

"Vaccination is certainly carried out vigorously in the island as is shown by the report on Sanitation. During the year, 149,901 subjects were vaccinated; of these 7,760 were revaccinations."

Smallpox. "There were 146 cases of the disease with 35 deaths in the north of the island and 118 cases were admitted to the Infectious Diseases Hospital, Kanatta which with two from another province made 120 with 32 deaths."

The total cases were 266 with 67 deaths, a fatality of 25.19 per cent., while in the epidemic reported by Christie the fatality was 22.42 per cent. A large proportion of the cases were undoubtedly vaccinated, but where the mitigation came in is not apparent.

Table II, showing fatalities occurring in the unvaccinated in six American hospitals during the 25 years 1870-94.

Place	Period	Cases	Fatality
Baltimore, Marine-----	1872	440	62.00
" "-----	1873	236	69.91
Boston, City-----	1872-73	113	48.76
" "-----	1894	33	54.54
Chicago-----	1894	1,378	65.45
Cincinnati Branch-----	1882	1,995	50.13
New York, Riverside-----	1875	561	53.30
" "-----	1882	293	53.56
Philadelphia Municipal-----	1871-2		
" Americans-----		534	64.23
" Germans-----		41	53.65
" Irish-----		86	67.44
" Municipal-----	1870-92		
" Americans-----		1,457	57.03
" Germans-----		59	57.62
" Irish-----		168	66.66

The fatalities given in the above table are termed by the advocates of vaccination "the natural" rate or that which would have prevailed throughout the entire body of patients if none had been vaccinated, subject however, to two possible deductions. 1st. That the disease may have been exceptionally severe during the time covered by the statistics. The vaccinators did not make that claim. On the contrary, the higher the death-rate the more it resembled smallpox before Jenner. 2nd. These are hospital fatalities and they are usually somewhat heavier than those of the general population. But in the London Hospital, in the quarter century immediately preceding the resort to vaccination, in an old building and with a body of patients constantly referred to as a refuse class, with a fatality the highest ever known in England or elsewhere

in civilized countries, the fatality was only one-half, 32 per cent., of that in the Philadelphia Hospital for a similar term of years three-quarters of a century later.

In Baltimore in 1821 a committee of doctors chosen by the profession at large, published an appeal to the people urging vaccination. They placed the fatality of the unprotected at "one in six." Fifty years later the fatality was four times that figure because the patients were unprotected by vaccination. In 1822 a committee of our National House of Representatives, reporting on a vaccination measure, placed the fatality of the disease at one in six; but our legislators made no inquiry when vaccinated soldiers died at nearly twice that rate.

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CHAPTER IV.

Audi Alteram Partem.

Pro-vaccinal Methods of Disproving Sortation.

The Very Young. The error caused by the excessive inclusion of young children can be readily removed by making comparisons between the vaccinated and the unvaccinated above five or ten years of age. This has been done repeatedly but without noticeable effect on the statistics.

The Sickly. In towns like Leicester, England, where the proportion of unvaccinated is very large, the presence of sickly children is to a less degree a disturbing factor. In this case the error is not removed; it is diluted. The statistics remain satisfactory to the vaccinators.

Hidden Scars. An attempt has been made to show that the danger of error through hidden scars has been largely done away with by the earlier arrival of patients at the hospitals through the operation of compulsory notification and removal laws. This is clearly an error. It is quite certain that when removal to a hospital was optional the parties controlling the disposition of a case of smallpox sent it away very promptly upon diagnosis, if they sent it at all. At the present time many are "hunted down" which implies a delayed arrival at the hospitals. This is more than theory. Gregory states of the patients in the London Hospital in 1828, evidently intended as a representative year, that "with few exceptions they were all admitted on the second or, at the farthest, on the third day of the eruption."¹

But Dr. Gayton, supporting the earlier arrival theory and presumably overlooking Gregory's statement, testified: "In the ordinary way we receive patients on or about the third day of the eruption."² He thought the cases of obscuration to be very few indeed, practically nil. Dr. Birdwood, another London Hospital Superintendent with an experience of about 12,000 cases of smallpox, gave testimony of a very different and of a less partisan character, as follows:³

31,235. Do you think it would be common for smallpox to occur in a patient, and from first to last, from the very commencement of the disease to the end, it would be quite impossible to recognize the scars of vaccination, would that be a common condition? Yes, fairly common.

31,236. Could you give any idea of the proportion of cases in which that occurs? No, I cannot.

Later he was asked if he agreed with the statement that there are "very few cases indeed in which the vaccination marks were obscured by the smallpox eruption?" and replied, "No, it is not in accord with my views."

It should be noted that the number of cases of hidden scars is of no moment. If only those cases were included where the obscuration was present on the first day of the eruption the error would be increased instead of diminished, for such cases would be exceptionally severe and show a very high fatality.

One defect runs through all of these efforts. It may be called the fallacy of the alternate elimination of co-ordinate factors. If we were considering the proportional attacks of the vaccinated and of the unvaccinated the factors mentioned would be coefficients and the elimination of either would be in part a correction or lessening of the error. But we are considering the proportional fatalities, and as the very young, the sickly and those with hidden scars, have about the same fatality, the elimination of one or two of these classes with one remaining does not materially effect the result. The method under consideration is simply a disguised proposition that if we scale down the cases and deaths proportionately the result will be unaffected. This will, of course, be conceded. It is evident, therefore, that we cannot make the vaccinated and the unvaccinated comparable bodies by any attempted elimination of disturbing factors. Fortunately, however, we can make them strictly comparable by an equal inclusion of these factors. We can study groups having about the same proportion of the very young, the sickly, etc., but with varying proportions in the number vaccinated. This will be done in the next chapter.

Attempts to Show That the General Smallpox Fatality Decreased as Vaccination Increased.

Despite the monotonous assertions that vaccination has made smallpox much less fatal as well as less frequent, only two writers, Dr. Gregory and Mr. Ballard, appear to have made any serious attempt to demonstrate this alleged truth statistically. Dr. Gregory recanted three years after publishing his paper. Mr. Ballard's results have been often used in the past, but are now rarely if ever referred to, but they have an historical value.

Gregory's Method.

In the report for the London Smallpox Hospital for 1825, the admissions and deaths year by year are given for the period 1776 to 1825, inclusive. In the first 25 years there were 7,017 admissions with 2,277 deaths, a fatality of 32.4 per cent. There were no vaccinated cases. In the second period the admissions were 3,743 and the deaths 1,118, a fatality of 30 per cent. Of these cases the vaccinated formed in 1810, 3; in 1815, 6; in 1819, 17, and in 1821, 29 per cent. The decline in the fatality of the disease was attributed to the presence of these patients. At that time this was a fair but not a necessary inference. In the early history of vaccination there were a number of its advocates that were pestiferously honest. Dr. Gregory belonged to that class and, holding that theories should give way to fact, he promptly made himself disagreeable by acknowledging his error.

Dr. Gregory's Revised Opinion.

"One of the most curious facts which a comparison of the experience of the Smallpox Hospital during the past year with former years has brought to light, is the singular coincidence in the mortality of the two periods in spite of the influence of vaccination. From observing the paucity of deaths in those who suffer under smallpox after undergoing vaccination it might be presumed *a priori* that the number of deaths by smallpox, per cent., would have diminished since the general adoption of vaccination. But the facts do not bear out this expectation."

Dr. Gregory here gives some statistics; altogether too few to support this view. Vaccination, in his opinion, had greatly reduced the total number of deaths due to smallpox and had diminished in an extraordinary degree the bodily suffering, the duration of the sickness and the fatality from the disease among the vaccinated, but without affecting the general variolous fatality. We will now recur to the text. "But how are we to explain the fact that the average rate of mortality by smallpox has not diminished since the discovery of vaccination? The principle can be no other than this — that the *modified* cases have taken the place of the *natural distinct* and in point of fact it will be found that the latter, formerly so common, is now become a very rare form of the disorder, insomuch that in the last two months not one case bearing that character has been admitted into the hospital."

"We may generalize one step further and lay it down as a great general law that there are certain constitutions which are naturally *patient* under the influence of the variolous poison. Prior to the discovery of vaccination these must have been far more numerous than at present. In consequence of the disuse of inoculation and the fewer foci of the poison now to be met with the disease fastens itself at present chiefly upon those whose constitutions are predisposed by weakness or some less cognizable circumstances—whose systems are exceedingly irritable under the operation of the poison and who therefore suffer severely from it. Hence the greater number of confluent and semi-confluent cases in the practice of the present day among the unprotected part of the community, while the proportion of mild and recoverable cases is kept up by vaccination."

"Whatever importance may attach to the explanation which I have just hazarded, the fact is undoubted that while the absolute mortality of smallpox has diminished in the most remarkable degree since the discovery of vaccination its relative mortality or rate of deaths per cent., remains precisely where it was in the earlier periods of the world.

As far back then as 1829, the attention of the medical profession was plainly and forcibly called by one of its most eminent members to the fact that the apparent lowering of the variolous fatality disappeared whenever the total fatality was considered. In the eighty odd years that have since passed not another advocate of vaccination has acknowledged the truth publicly. The other fact testified to by Dr. Gregory that the "natural distinct formerly so common" had been displaced by the so-called varioloid has been similarly ignored. Dr. Gregory's faith in vaccination prevented his seeing that the displacement was simply one of terms.

Ballard's Method.

This writer's attempted demonstration will be examined here under two headings: English, and Continental Statistics. A table which forms a part of his argument will be considered in Chapter v.

Ballard's English Statistics.

"Smallpox among the unprotected has lost nothing of its original virulence; but taking the masses of the people among whom it now breaks out, vaccinated and unvaccinated together, it has become a less fatal disease than it used to be among those attacked by it. Thus we learn from Dr. Gregory that during the twenty-five years preceding the introduction of vaccination, the fatality of smallpox in the hospital at Battle Bridge was 32 per cent. of all that were attacked. In the epidemic of 1838, out of 694 persons admitted 188 died or 27 per cent. Of these, four-sevenths only had been vaccinated previously. In 1842-44 the fatality of smallpox was 21 per cent., in 1851 it was 15 per cent., in the severe epidemic of 1863 it was 17 per cent. and in 1866 it was 13 per cent. Thus as vaccination has progressed among the people the fatality of the disease, as shown by the records of this hospital, has gradually lessened."⁵

At the time Ballard wrote there had been a marked decline in the fatality of the disease in the London Smallpox Hospital, but in no other hospital or locality had any similar decline been noted.

Indeed it is possible to furnish an exactly opposite experience. In the Municipal Hospital at Philadelphia the cases and deaths for 52 consecutive years divided as nearly as possible into three equal terms of years give these results:

Term		Cases	Deaths	Per Cent.
1st	----- 1840-56	1,383	254	18.37
2nd	----- 1857-72	3,471	918	26.45
3rd	----- 1873-92	2,623	819	31.22

It is probable that the proportion of the vaccinated steadily increased in these groups. These figures are somewhat manipulated. The increase in fatality was not steadily progressive as the above facts would seem to show. There was a sudden increase from less than 19 per cent. to more than 31 per cent. with the onset of the epidemic in 1872-73. This higher fatality persisted for more than a quarter of a century, when it declined coincidentally with a great decline in the number of the vaccinated patients, though of course, not due to that fact.

The manipulation referred to above, i. e., the drawing of a purely arbitrary divisional line in order to secure a desired result, is exceedingly common in pro-vaccinal literature. Mr. Ballard's citation of the London Smallpox Hospital statistics to prove a general decline in the smallpox fatality was disingenuous. He must have known that the phenomena noted was strictly institutional. His own statements show that there must have been some other factor more potential than vaccination present, for with four-sevenths of the patients admittedly vaccinated the fall in the fatality was from 32 to 27 per cent., while later there was a fall from 27 to 13 per cent. with a large proportion of the remaining three-sevenths still unvaccinated. Mr. Ballard's work appeared at a time when the smallpox fatality was exceptionally low in most if not in all countries. With the occurrence of the pandemic of 1869-1874 there was a general increase of about 50 per cent. in the fatality of the disease despite the most thorough-going vaccinations. In the same hospital it rose to 21 per cent. in 1872, though the vaccinated had increased to 88 per cent.

Ballard's Continental Statistics.

"Foreign observations confirm the fact of the generally less fatal character of smallpox. Assuming one in three or one in four as the ratio of fatality prior to the introduction of vaccination—and it cannot be said to be an exaggerated estimate of it—we have from continental sources the following results:

			The Fatality was	Per Attacks
In the epidemic of	Garouge-----	1828	10.7	100
"	" Geneva -----	1832	10.5	100
"	" " -----	1845	5.0	100
"	" " -----	1858-59	10.8	100
"	" Vesey -----	1858-59	5.5	100
"	" Rouen -----	1864	11.11	100
"	" throughout France-----	1861	18.0	100
"	" " -----	1862	13.5	100
"	" " -----	1863	10.9	100
"	" " -----	1864	11.1	100
"	" of Wurtemberg-----	1831-36	11.8	100

Mr. Ballard's method was at once easy and worthless. His assumption that "one in three or one in four" was the usual fatality of the disease "prior to the introduction of vaccination" is without the slightest warrant outside of the London Smallpox Hospital. What prevaccinal writers claimed in regard to the fatality of smallpox in France, Germany and Switzerland has already been shown.

The cases of smallpox in France 1861-64, inclusive, the period selected by Mr. Ballard, were 63,817, the deaths 8,289 or 12.99 per cent. Dr. Starke, an earlier champion of vaccination, in a published paper gives the French figures for 1808 to 1843, inclusive. The totals are cases 670,717, deaths 96,419, per cent. 14.37. Of these figures he remarks: "If we look to the mortality, however, of this disease in France during the years above mentioned we shall see that it is the very same as before the introduction of vaccination, being about one in seven attacked with the disease. "The fact then of itself demonstrates that the cases attacked were those that had never been vaccinated." This conclusion is, however, verified by the last French Government Report which has reached me,

viz., that of 1843, published in the *Journal des Debates*. After enumerating the births and the number of vaccinated it states that "of those not vaccinated 11,117 were attacked with smallpox."⁶ In fact the number of cases given in the table above. The deaths in 1843 were 1,379 or 11.7 per cent.

Both writers were ardent advocates of vaccination and believers in the infallibility of their figures and of their own deductions, yet from what are essentially the same statistics one demonstrates that there are many vaccinated cases included and that as a consequence the fatality has been cut one-half or more, and the other shows that only the unvaccinated take smallpox, and therefore the fatality remains unchanged.

Pro-Vaccinal Explanations of the Increased Fatality of the Unvaccinated and of the Vaccinated. Actual or Apparent.

Generally speaking, as the 19th. century advanced, the proportion of the vaccinated in localities and hospitals increased in all civilized countries until the pandemic of the early 70s, and consequently the fatality of the vaccinated and of the unvaccinated increased, until in the case of the latter class the average as compared with that of prevaccinal times was generally doubled and in some instances more than quadrupled. Naturally the anti-vaccinators have given this fact much prominence and have succeeded in drawing out denials and admissions with explanations. Few of the efforts call for serious criticism; they are given here mainly to show the complete inability of the vaccinators to agree upon any interpretation of conceded facts of primary importance, and this, too, in a matter where their opponents are in complete harmony. The anti-vaccinators hold with absolute unanimity that the rise in the fatality of the unvaccinated is due to the fact that as the proportion of the vaccinated increases in any group or body of persons the unvaccinated become progressively more and more exclusively a body of variolous unfits and that under the same conditions the fatality of the vaccinated rises because they become less and less a select body until all are vaccinated when selection van-

ishes and their fatality becomes identical with the fatality of mixed groups if otherwise comparable.

Change of Type Theory (Cory).

"When a disease has become endemic in a country for some centuries and spreads among a population unchecked we generally find the tendency is for the mortality from such a disease to decrease. Especially would this be the case with a disease like smallpox, which we have already shown to be a disease of childhood in unvaccinated communities. Almost everybody has the disease at some period of life, in the great bulk of people before they are twelve years old. Hence most individuals would have had their attack of smallpox before marriage, and chiefly those who had successfully combatted the disease would be propagators of their race. We will take for granted the fact that physical qualities are largely inherited and therefore the children of those parents who have successfully combatted the disease would be more likely to combat successfully with the same disease, i. e., they would inherit a power more or less of resisting death from smallpox and in this sense might be called stronger than those who would die. The population would after some years become gradually strengthened against death from smallpox and the mortality of the disease would decrease. Any method which would allow all to live and propagate their kind, such as vaccination, would remove this means of strengthening the population against smallpox, and hence those of the population who did not avail themselves of the method of safety would after some years feel the brunt of the disease and thus the fatality would gradually increase among them to such a degree as we know the mortality to be among a community which has never as yet had the disease or not had it for a long time among them."⁷

Our knowledge of the fatality of smallpox among people who have not been "strengthened" in the manner indicated is very slight. Dr. Cory fails to give any facts to sustain his theory that the disease had grown or was growing milder in England or else-

where before the era of vaccination. As far as the London Smallpox Hospital experience goes the disease was growing more virulent. In the years 1746 to 1762 the fatality was 26 per cent., while in the last 25 years of the century it was 32 per cent. Jurin's figures collected during the first quarter of the century were lower, if anything, than those obtained later. Even among strictly primitive people with no history or tradition of smallpox, as at Ponapi, 50 per cent. seems to be the extreme estimate, while the unvaccinated fatality in civilized communities very frequently goes much higher. It is centuries since the English have been strengthened by the plague, yet when attacked in India or China the fatality is much lower than with the natives. If Dr. Cory's theory is correct scarlet fever, measles, yellow fever and typhoid fever should all be growing more virulent, but this is not the case.

Change of Type Theory (Cameron).

In a letter by Charles Cameron, M. D., M. P., criticising Mr. Buchanan's Memorandum, he states: "Since vaccination has been introduced the mortality in the recorded cases of smallpox in unvaccinated persons has steadily increased, though in a much smaller ratio than in the vaccinated cases. At the beginning of the century only one person died out of every four or five unvaccinated persons attacked; in the last epidemic in London the mortality was not far short of one death in every two cases. What is the cause of this? I strongly suspect that it is due to the displacement of the mortality from smallpox which has occurred through vaccination. Before vaccination the great mass of smallpox cases occurred in young children. Since its introduction young children have been spared and the disease has propagated itself on adults. Pasteur, in his remarkable experiments on the cultivation of disease organisms, has shown that in certain cases their cultivation on young animals rapidly increases their own virulence and the fatality of inoculations with them. May not the converse be true in cases of smallpox? May not repeated cultivations of smallpox on adults produce a greater virulence of the infecting organ-

ism than resulted when it chiefly propagated itself upon children? Be that as it may the mortality in unvaccinated cases has gone on steadily increasing." ⁸

Dr. Cameron's suggestion is simply a wild guess. Not a supporting fact has been given and the guess has received no attention. A sufficient answer would be that the adult fatality, ignoring the matter of vaccination, has markedly fallen, while that of the minors remains practically stable; yet both classes derive the contagion from the same source. His theory is worthless, but his confession that the fatality of the unvaccinated cases has steadily increased up to the pandemic of 1871-73 and that he knows of no adequate explanation is a frank admission that the vaccinators are living in puzzledom.

The Chickenpox Theory.

Dr. McVail of Glasgow is the chief exploiter of this theory. It is alleged that in 1767 Heberden, a London physician, distinguished for the first time between chickenpox and smallpox, and soon thereafter the two diseases ceased to be confounded. As a matter of fact Heberden never made such a claim. He evidently was a well-informed man and incapable of such a blunder. He writes that a knowledge of this disease "is of importance on account of the smallpox with which it may otherwise be confounded and deceive the persons who have had it into a false security which may prevent them from either keeping out of the way of the smallpox or from being inoculated." ⁹

It was the people who had the disease without medical attendance that were deceived, and not the doctors. This is made apparent by this further statement: "They occasion so little danger or trouble to the patient that physicians are seldom sent for to attend them and have therefore few opportunities of seeing this distemper."

Certainly he was not the first medical writer, by at least forty years, to recognize chickenpox as a non-variola disease. Twenty

years before the date assigned for the discovery another London physician wrote in a published synopsis of his lectures to students: "The pustules in the swinepox and in the chickenpox are described so as to be known and distinguished from the pustules in the smallpox."¹⁰

About the same time a second writer referring to the great frequency of smallpox, remarks: "In this calculation are not to be reckoned the pustules that somewhat resemble the smallpox which are vulgarly called the chickenpox." A few years earlier, a third author, dealing with smallpox, refers to a kind of pustules "common to children," adding, "These the country people call Swine, Hen or Chicken pox."¹¹

As early as 1730 a country doctor wrote: "The pestilence can never breed the smallpox nor the smallpox the measles, nor they the crystals or chickenpox any more than a hen, a duck; a wolf, a sheep; or a thistle, figs." On another page he repeats: "The smallpox (as before said) keeps precisely to its own family, so as never to produce the chickenpox, measles or any other distemper whatsoever, but the true smallpox only."¹²

If the doubling of the fatality of the so-called natural smallpox was due to the exclusion of chickenpox cases, or other Eruptive Diseases of a non-fatal type, then of 100 cases of supposed smallpox 50 would be of a non-variola character, and of the recoveries 32 would be "protected" and 50 deceived. Is it possible under such circumstances that English doctors should hold that recurrent smallpox was a matter of extreme rarity? Yet Heberden, who is alleged to have discovered this great error in diagnosis, writes of recurrent smallpox: "not above one in ten thousand patients is pretended to have it twice."

Dr. McVail's theory also impeaches the intelligence of his profession, for it appears that a hundred years had passed before any doctor recognized that the supposed discovery had invalidated all of the pre-existing fatality statistics.

Infants Omitted Theory.

This is another of Dr. McVail's suppositions. Among the sev-

eral towns from which Jurin secured returns there was one, Anyho, where the ages and cases as well as the deaths were reported. In the five or six years during which the observations were made there were 132 cases of smallpox with 22 deaths or 19.0 per cent. There were no cases mentioned in the first two years of life. On this fact and on some other even more fragile evidence Dr. McVail built his theory and presented it to the Royal Commission. Notwithstanding the Commissioners' desire to find a solution of the puzzle they rejected the proffered explanation in these terms:

"It has been urged that the deaths of those dying under two years of age were excluded from Jurin's statistics, and that this must have led to the omission of many deaths, as the mortality in that class was high. The evidence relied on to show that cases under two years of age were excluded certainly cannot be regarded as establishing it."

The fatality at Anyho was above the average, perhaps because there were so few young children affected. In Chester, another of Jurin's towns, there were in 1774, 1,202 cases of smallpox with 202 deaths, and of these deaths 89 were under two years of age, yet the fatality, 16.81 per cent., was just about the average. The evidence available seems to show that in towns like Chester, where no effort was made to control the disease, smallpox was very common in young children because they furnished the bulk of the susceptibles, while in the more rarely visited towns children under the mixing age suffered but little. Whatever may be true at the present time the disease was always described as mild in infants by the older writers. Morton states: "For that they are less anxious about the result, infants feel its destructive force more rarely than others." Rosenstein writes: "Young people go through the disease with more facility than older persons, and the younger they are the more successful generally is the issue. Nevertheless we have the instances of children who have got a malignant sort of smallpox and died though they still were not weaned." ¹³

Provincial Experience Theory.

"The London smallpox unvaccinated case mortality is roughly double figures given in times preceding vaccination." "The reason is probably in part that the unvaccinated patients come from a different class of the population; from a class that is in the aggregate not so healthy."¹⁴

Dr. Nivens gives as an added but more important reason, "In many parts of the country in prevaccination times smallpox would not occur every $4\frac{1}{2}$ years but would occur at longer intervals. It would then find a large number of people at the hardy ages of 5-20, and the mortality amongst these being comparatively low, and the number effected comparatively large the total mortality from smallpox would be dragged down. This, I believe, is the more likely solution of a difficulty which Dr. Newsholme mentions in his work on statistics and which he explains by change of type. But supposing this to be the partial explanation for London, it is not a complete or satisfactory explanation and I believe the more provincial experience is looked up the more will the above explanation be found the main part of the solution."

A serious objection to this theory lies in the fact that in the 18th. century physicians having good opportunities for observing, said the effect of widening the inter-epidemic period was just the reverse of what Dr. Nivens assumes it to have been. Thus Dr. Douglas writes: "I am persuaded that during the last 22 years absence of smallpox in Boston, from 1730 to 1752, if it had been allowed its free course, considering that persons when children would have been the subjects of it, fewer would have died of it than have died of it in a few months 1752."

Dr. W. M. Feldman's Theory.

The Doctor engaged in a discussion with the Secretary of the Anti-Vaccination League in England and his reply, in part, reads: "To explain why the mortality is higher now than in prevaccination times hardly comes within the province of this discussion, but as you ask for the explanation I will give you my own

theory. The prevaccination 18 per cent. was of course an average of mild and severe epidemics. The mild smallpox has now very little chance in well-vaccinated centres, while the severe kind kills a high percentage of the unvaccinated. In anti-vaccination centres, therefore, like Leicester, mild smallpox has a chance of spreading. Also there is no means of obtaining complete and reliable returns in prevaccination times.”¹⁵

This is the latest explanation and while it cannot be said to be the best it is as good as the rest and serves to show that up to 1913 the puzzle still exists. Mild smallpox spreads alike in well and in poorly vaccinated communities if the initial cases are not promptly isolated, and this fault is most likely to occur when the disease is mild.

The Professional Attitude Towards Inquiry.

Do doctors believe in vaccination? The answer to this question is wholly dependent upon the connotation you place upon the term belief. It is a very elastic word and covers a wide variety of mental states. The young man who at the suggestion of the Professor accepts a feather pillow for a baby and tries to feed it, using a whisk broom as a nursing bottle, acts according to his belief, and though he appears to be exceptionally well situated for knowing what he holds in his lap, he in fact knows less than any of the more or less remote spectators that witness his antics.

Some years ago I said to a young man about to enter upon the practice of medicine: “Now, Charles, you will for a while at least have some spare time. Suppose you look up this matter of vaccination. You will find it a myth.” I knew a great deal on the subject of vaccination, few men knew more; but I erroneously believed that every doctor, certainly every young doctor, would be glad to have any alleged defect in medical teachings pointed out to him and that he would take the earliest opportunity to investigate the matter. It was evident that I needed a lesson in human nature and I got what I needed “hot from the bat.” He said: “I will do no such thing. I believe in vaccination. I was

brought up to believe in it; my medical education has confirmed that belief. I am going into the practice of medicine to make a living by it, and for a while at least I shall want and probably need every dollar I can make honorably. There is something for me in vaccination. How much I do not know; but be it little or much I want it. I believe you are mistaken, but whether you are or not I do not intend to spend my time inquiring into the correctness of accepted medical teachings when the only result of a change of opinion would be a loss of fees and professional ostracism. If you can see any way of making anything out of it go ahead and make it. I don't intend to try."

Was Charles' attitude that of the profession generally? I think it was and is today though to a diminishing extent. When the "regulars" find that a steadily increasing number of their patrons distrust and in many instances abhor vaccination and that these patrons are turning for medical advice and treatment to Homeopaths, Eclectics, Osteopaths, Naturopaths, Chiropractics, etc., because of this distrust they will be more disposed to listen. The claim that smallpox is just as fatal and that the proportion of severe cases is just as large as before Jenner is an important one and is and has been entitled to careful consideration. I have quoted a varied assortment of explanations. I now append the testimony of the three witnesses appearing before the Royal Commission on Vaccination who were cross-examined on the subject. They illustrate the most common, the contemptuous treatment of the anti-vaccination claim, the attitude of Charles.

Examination of Mr. R. D. R. Sweeting, M. R. C. S. Supt. of the Western Hospital.

3735 (Mr. Picton). With regard to the column showing the fatality in the unvaccinated in your second table, how does that general proportion of fatality of 46.08 compare with the fatality before the introduction of vaccination? There are no accurate data, I believe, as to prevaccination fatality. The fatality at the London Smallpox Hospital at the end of the last century was, I

believe, close on 30 per cent.; amongst hospital patients, it would perhaps be higher than among the general population. I am not aware of any trustworthy statistics of the actual fatality in prevaccination times.

3736. Do you think that the London Smallpox Hospital reports from 1746 to 1863 could be relied on? I should think they could, age for age.

3737. Is not the general result held to be that the fatality was a little over 18 per cent. on the whole? That has been stated, but I do not think it has ever been proved that it was so low as that; there are no accurate data to go on.

3738. Just now you said that in the London Smallpox Hospital the fatality was said to be 30 per cent? Speaking from memory, I believe it was 30 per cent. at the end of last century.

3739. That would appear to be 16 per cent. lower than the fatality in the Western Hospital? Yes.

3740. Do you think there is any explanation to be given of that? I do not know what explanation can be given of it.

3741 (Dr. Collins). Has smallpox become more fatal in this century? I cannot say.

3768. Out of a total unvaccinated class of 358 I observe that 329 are recorded as severe cases? Yes.

3769. Can you tell us whether that would or would not be a large proportion of severe cases as compared with prevaccination times? I could not tell you at all; these are my observations, but I have no data with regard to prevaccination times.

Examination of William Gayton, M. D., Medical Superintendent of the North Western Fever Hospital.

1746 (Professor Michael Foster). Your total result of mortality is 17.3. You probably know that it has been stated that the smallpox fatality in the last century was 18.8 and in the early part of this century 18.5; as you are running so very close to it as

17.3 have you formed any ideas about that? Of course the mortality is made up to a very large extent of the unvaccinated.

1747. It is very curious that the figures should run so near together as 18.8 in 1760, I think 18.5 in 1830 and 17.3 in 1870? It seems a very difficult thing to come to any conclusion as to what the mortality was before civil registration began.

1748. It has been stated that in smallpox hospitals in the last century the mortality of the cases was 18.8? May I inquire whether that was estimated upon large numbers or upon very small numbers?

1749 (Dr. Collins). It was upon 18,000. That is a very fair number, but I have not considered the point.

1853 (Dr. Collins). As to the mortality of hospital smallpox formerly, do you think there is any reason to doubt the accuracy of the statement that hospital smallpox before this century gave a mortality of 18 per cent? No, I do not know that there is any reason to doubt the correctness of the statement.

1854. Have you formed any judgment in your mind which would explain the reason why with the large diluting effect of vaccination, as many as 80 per cent. of smallpox cases being vaccinated, the mortality remains at about 18 per cent? No, I do not know of any explanation that I can give, except that the unvaccinated and the badly vaccinated produced the larger share of the admissions.

1855. Natural smallpox, as you term it, apparently now gives a mortality of 46 per cent? Yes, something like that.

1856. But natural smallpox in the last century apparently gave a mortality of 18 per cent.; you have no explanation to offer as to that? No.

Examination of Thomas W. Grimshaw, M. D., Registrar-General for Ireland.

2998 (Dr. Collins). In Table G I observe that you give the total mortality of the vaccinated and of the unvaccinated to-

gether as 21.3 per cent. Can you tell us how that compares with the mortality of the unvaccinated in prevaccination times? No, I cannot. Compared with these figures it is 63.9 deaths for the unvaccinated and for the vaccinated 11.7. I could not tell you anything about prevaccination times.

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CHAPTER V.

Analytical Examination of Smallpox Fatalities.

Tri-ratio Analyses—American Experience.

I have shown in a measure at least wherein the vaccinated and the unvaccinated differ, apart from their vaccinal condition. I now purpose to show that the differences noted in the constitution of the classes, plus the accessory manipulations due to class, educational and pecuniary bias are sufficient to explain the difference in fatalities which are commonly held to demonstrate the presence of mitigation. This will be done by substituting the method of concomitant variations for the method of differences now universally relied upon by vaccinators to support their contention. If the sortation theory be correct, a study of smallpox fatalities by the indicated method will necessarily show the existence of three vaccino-statistical laws, as follows: 1st. The fatality of the vaccinated rises or falls as the proportion of the vaccinated increases or diminishes. 2nd. The fatality of the unvaccinated rises or falls as the proportion of that class diminishes or increases. 3rd. The fatality of the entire group is unaffected by variations in the proportion vaccinated. On the contrary, if the mitigation theory be true then the fatalities of the vaccinated and of the unvaccinated will remain unaffected by variations in the proportion vaccinated, but the general or combined fatality will respond to variations in the proportion of vaccinees.

It is obvious, therefore, that the question of mitigation resolves itself into an arithmetical problem of very simple character provided we can procure for study groups of smallpox patients comparable in all respects except vaccination. This is not an easy task, especially in this country. One difficulty lies in the heterogeneous character of the population, one city being largely Irish, another German and a third Negro. As these classes have a widely differing death-rate from all causes it is probable that their fatalities in smallpox would also differ widely independently

of vaccination. So also there is a marked difference in the character of the cases included in the different hospitals. Thus in Boston during 16 months, in the years 1872-73 there were in three hospitals located in the city 887 cases, with 200 deaths or 22.55 per cent., while in Galloupe's Island hospital there were 2,845 cases with 826 deaths or 29 per cent. The latter cases cannot be used for want of particulars. The Marine Hospital of Baltimore and the Municipal of Philadelphia, appear to have treated the quarantine cases. Again I have been unable to find in our health reports or other literature any groups of hospital returns. This makes it necessary that I should compile the tables and might lay me open to the charge of manipulation, a thing very easily accomplished. All of these obstacles are largely avoided by using English statistics, and as a consequence most of the tables will represent English experience. Qualitatively, however, this country maintains its supremacy. The data obtainable from the records of the Municipal Hospital at Philadelphia are nearly ideal. One doctor was in charge for more than thirty years. He believed that every time he demonstrated the lower fatality of the vaccinated he justified his claim that an opponent of vaccination is "an enemy of society and should be dealt with as such." Accordingly, he classified his patients into Blacks, Whites, Natives, Germans, Irish, Other Nationalities, Unknown Nationalities, Patients Under 14 Years, Patients Over 14 Years, and All Patients. He started in this way and he persevered to the end.

In the following table, Series i. gives the figures for the epidemic period 1871-73. Series ii. is for the years 1874 to 1892, inclusive. The data for Series ii. were obtained by deducting the figures in Series i. from those given in a table for 1871-92. Every group is here examined that shows a 10 per cent. variation in the proportion vaccinated. In some of the groups the variation was very trifling. In the Germans it was 1.77 per cent., in the Irish 5.29 per cent. and in patients over 14 years 2.30 per cent.

An examination of the table shows that in every instance, fifteen in all, the results obtained are more in accordance with

the sortation theory than with the opposing contention. In two classes, however, the Blacks and those Under 14 Years, there is a marked increase in the total fatality coincident with a falling off in the proportion classed as vaccinated. With the Blacks the increase is nearly one-half the theoretic expectation. But in those Under 14 Years the increase is less than a quarter of the predictable amount. In both classes, I believe, the partially favorable results secured were due to changes in the classification. So far as the Under 14 Years class is concerned we have an illustration and a confirmation of what is taught in Chapter vi. the only difference being that the age line is drawn at 14 instead of 10 years. The case of the Blacks will be considered in connection with an instructive puzzle which Dr. Welch noted. In both classes the increased fatality disappears when the apparently losing class is joined with its complementary group; the Blacks with the Whites, the Under-14-years with those above that age.

**Examination of 5,000 Cases of Smallpox Observed by Dr. Wm. M. Welch
in the Municipal Hospital, Philadelphia, 1872-1892.**

TABLE III.

Group	Series	Vaccinated cases	Unvaccinated cases	P. C. vaccinated	Vaccinated deaths	Unvaccinated deaths	Vaccinated fatality	Unvaccinated fatality	Comb'd fatality
Whites	1	1,613	403	80.01	325	270	20.15	66.99	29.51
"	2	1,414	770	64.74	215	411	15.21	53.38	28.66
Blacks	1	201	160	55.68	53	95	26.37	59.37	40.99
"	2	160	279	36.45	31	162	19.37	58.06	43.96
Natives	1	846	534	61.30	150	343	17.73	64.23	35.72
"	2	809	923	46.65	124	488	15.33	52.87	35.33
Under 14 yrs.	1	111	197	36.04	13	105	11.71	53.29	38.31
" 14 "	2	63	507	11.05	2	231	3.17	45.56	40.88
All patients	1	1,629	748	68.53	276	467	16.94	62.52	31.25
"	2	1,519	1,104	57.91	236	583	15.54	52.76	31.22

SORTATION THEORY.

ERRORS.

MITIGATION THEORY.

Whites	-----	— .85
Blacks	-----	+ 2.97
Natives	-----	— .39
Patients under		
14 years of age	-----	+ 2.55
All patients	-----	— .03

Whites	-----	— 8.00
Blacks	-----	— 3.31
Natives	-----	— 6.20
Patients under		
14 years of age	-----	— 7.84
All patients	-----	— 4.87

On the Determination of Errors.

As the casual reader with the time and thought he is disposed to give to the subject may not recognize the method by which the errors noted were ascertained it will be well perhaps to state the process. From an anti-vac point of view the two general or combined fatalities of the compared groups should be the same if the groups were strictly comparable except as to vaccination. By deducting the smaller from the larger fatality and prefixing a plus or a minus sign as the case may require, we get the error according to the sortation theory. As the experiment is less perfect than the law, error of some amount, especially where the figures are carried out to four places, should be expected in all cases, though the errors plus and minus should balance each other in the long run if the method I have devised eliminates entirely all forms of sortation, a somewhat doubtful proposition.

In a supposed hospital there were 50 per cent. of the patients vaccinated with a fatality of 10 per cent. The 50 per cent. unvaccinated died at the rate of 40 per cent., making an apparent saving of lives by vaccination of thirty in one hundred. What would be the effect of increasing the number vaccinated by 10? Obviously, the saving of three lives and a cutting of the general fatality from 25 to 22 per cent. To get the error then, mitigation theory, we multiply the difference between the percentage of the vaccinated in the two groups, which in the supposed case is ten, by the difference in the fatalities of the vaccinated and the unvaccinated in the first group which in the supposed case is thirty, deduct the product 3(00) from the total fatality, 25, of the first group and we have the result that we have a right to expect from pro-vaccinal premises. Now deduct the actual fatality from the theoretic fatality thus obtained and you have the error mitigation theory. If there is a falling off in the proportion vaccinated we add the product obtained in the manner stated instead of deducting it.

Dr. Welch's Anomalous Experience.

The physician in charge of the Municipal Hospital of Philadelphia, during the epidemic of 1871-72, had a puzzling experience. Its nature is shown in the two following tables and the Doctor's comments:

All Patients

TABLE IV.

Color	Admitted	Died	Per Cent. of Deaths
White -----	2,016	595	29.51
Black -----	361	148	40.99
Totals -----	2,377	743	31.25

Unvaccinated Patients.

TABLE V.

Color	Admitted	Died	Per Cent. of Deaths
White -----	408	270	66.99
Black -----	160	95	59.37
Totals -----	563	365	64.83

By the first of these tables it appears that the fatality of the blacks exceeded that of the whites by 11.48 per cent. when the total cases of the two races were compared. The second table shows that the fatality of the whites exceeded that of the blacks by 7.62 per cent. when the comparison was made between the unvaccinated.

In commenting on the last table Dr. Welch says: "It is generally supposed that smallpox proves more fatal among the colored race. The above table certainly does not bear out this supposition. It is obvious how a wrong conclusion might be arrived at upon this point by consulting simply the facts as set forth in the table preceding the last. The only fair way, however, of determining the question is by making the comparison according to the last table where the unvaccinated or unprotected cases only are taken into account."

Dr. Welch's position was sound. Vaccinators, when studying racial fatalities in smallpox, should compare the unvaccinated and not entire race groups. It is an awkward fact, however, that the fatality among the blacks in the Northern States, at least, was much heavier last century than among the whites.

The explanation of the puzzle is simple. There were 44 per cent. of the blacks unvaccinated and only 21 per cent. of the whites; consequently under the law before stated that the fatality of the unvaccinated rises as the class grows numerically weaker the fatality of the unvaccinated whites rose until it exceeded that of the unvaccinated blacks, notwithstanding the perturbing effects of race.

In a later paper Dr. Welch reverts to this subject and gives similar tables with an analysis of 5,000 cases covering a period of 20 years. Comparing the several tables it appears that in the years subsequent to the recognition of the puzzle the White unvaccinated fatality fell off from 67.00 per cent. to 53.38 per cent. while the Black unvaccinated fatality dropped from 59.37 to 58.06 per cent. This made the unvaccinated fatalities of the two races more in accordance with Dr. Welch's expectations. He, however, repeats in substance the comments quoted and still finds his experience at variance with that of physicians who did not have the light of vaccine statistics to guide them.

I have surmised that there was a change in the classification of the Blacks that caused the rise in the fatality of that group. Not the slightest imputation is intended on Dr. Welch's fairness. He was puzzled; that is clear. Presumably he sought a solution. Now in the smallpox epidemic of 1874-75 in Mobile the fatalities were: Whites 23.34, Blacks 28.98, Mulattoes 21.37. If similar ratios were present at the Municipal Hospital and the fact noticed by the Doctor, it would have been a very natural and wholly proper procedure to thereafter class the Mulattoes with the Whites, if this had not been done before. The effect of such a change would be to increase the fatality of the Blacks to a marked extent and to lower the fatality of the Whites very slightly. Both of

these changes did result from some cause. Again, the increased fatality of the Blacks is fully offset by the decreased fatality of the Whites as can readily be seen by the figures for All Patients.

Table iii. was in substance prepared about fifteen years ago. Since then Dr. Welch and an associate have published a table also showing the experience of the Municipal Hospital but having a different divisional period.¹ It is here utilized.

Mortality Rate of Vaccinated and Unvaccinated Cases at Different Epidemics.

TABLE VI.

1871-1872	Cases	Deaths	Percentage
Unvaccinated -----	697	449	64.41
Vaccinated -----	1,629	276	16.94
Total -----	2,326	725	30.74
1881-1885			
Unvaccinated -----	447	252	56.37
Vaccinated -----	551	81	14.70
Total -----	998	333	33.36
1901-1904			
Unvaccinated -----	1,943	636	32.73
Vaccinated -----	1,844	124	6.72
Total -----	3,787	760	20.06

The percentage 30.74 is an error. It should be 31.17 and my calculations are based on the corrected figures. The results are: Most vaccinated group; per cent. vaccinated 70.03; fatalities 16.94, 64.41 and 31.17. The figures for the least vaccinated group are 55.21, 14.70, 56.37 and 33.36. Error sortation theory + 2.19, mitigation theory — 4.41.

The authors of the above table knew that the proportion of vaccinated patients in the hospital was falling and as a consequence the total fatality ought to increase. They knew that if they took a long term of years as I have done in Table iii. the increase did not materialize. On the contrary, there is a slight decrease. They therefore selected a divisional period when

a temporary fluctuation in the fatalities favored their contention. Even with this expert device the increase was a trifle less than one-third of what it should have been according to their teachings. The third group, 1901-1904, relates to a period when the smallpox fatality was very low all over the country and does not affect this inquiry.

Tri-ratio Analyses. English Experience. Method of Inquiry.

Every group or table containing six or more primaries that I have met with, without exception, giving English experience is here studied if the contrasted sub-groups showed a difference of 10 per cent. or more in the number of vaccinated. Each group of primaries is divided into sub-groups. The three or more primaries showing the larger proportion of vaccinated cases form the most vaccinated group and the remaining primaries the least vaccinated group. In every case where the group studied contained an odd number of primaries the one with the fewest cases is omitted in the calculations in order that the sub-groups shall have an equal number of primaries and thus exclude a possible manipulation, by placing the odd primary where it might affect the result.

One table, that from Mr. Ballard's work, does not strictly represent English experience; but as it does so in part and as it was found in an English pro-vaccinal work it is here utilized.

Throughout my computations I use the figures of the most vaccinated group as the index series. This tends to make the error, mitigation theory, larger than it would be if the figures of the least vaccinated group were used. Seemingly we ought to get the same result whether we measure upwards or downwards, but as a fact we do not. Thus in the preceding table the difference between the fatalities of the vaccinated and of the unvaccinated in the most vaccinated group is 45.58 and in the least vaccinated group 37.22, so that in this instance if we measured upwards the multiplier would be diminished by 8.36 and the error would be 3.98 instead of 4.87. This condition would not be present

if the difference between the fatalities of the vaccinated and of the unvaccinated were due to vaccination. In that case the divergences would remain the same whether many or few were vaccinated. The condition noted would, however, be necessarily present if sortation were present.

In all of the analyses the arithmetic average is used as is customary in work of this kind. I have, however, used the weighted average experimentally and found that usually it gives a similar result to that given by the arithmetic average.

Desiring to see what would be the effect of a study of a later epidemic in the towns selected by the Royal Commission and by Mr. Hart I have compiled a table of six English hospitals epidemic period of 1900-04. The table embraces all the towns for which I have seen returns. The summary that will be given will thus include eight tables, five grouped by advocates of vaccination and three by opponents of the practice.

Statistical Examination of 15,227 Cases of Smallpox Occurring in Various Localities and Countries. Grouped by Mr. Ballard.²

TABLE VII.

Locality	Year	Cases	Per Cent. Vaccinated	Fatalities Vaccinated	Unvac'd	Total
Norwich ----	1819	202	0.99	0	23	22.7
Marseilles ---	1828	6,020	33	1	25	17.0
Rouen -----	1864	821	76	1	32.8	9.0
London S. P. Hospital --	1866	2,037	79	7.3	35.7	13.2
Prague -----	1840	5,209	52	3	15.3	8.9
Jamaica -----	1857	608	20	3.3	15.7	13.3
Edinburgh Royal Infy	1863	330	62	1.9	33	13.6

The original table was especially constructed to make it appear that the general, variolous fatality declined as vaccination became more common. To do this Mr. Ballard embraced in his table epidemics occurring in the wide range of years 1819 to 1860, and in five widely separated countries or localities, viz: England, Scotland, Germany, France and Jamaica. The Norwich fatality

was exceptionally high. There was an earlier epidemic in 1807 in the same city of much greater extent and with lower fatality (1,200 cases with 203 deaths, 16.9 per cent.) He had no use for that. The London Hospital fatality taken for a single year only, was exceptionally low. He used that. The Prague cases not improbably included chickenpox and they were valuable. Notwithstanding these manipulations, if we deal with the table according to the rule, that is, to strike out the primary with the smallest number of cases, where there are an odd number of primaries there will be no occasion for further demur. The most vaccinated group has 72 per cent. vaccinated, the least vaccinated 35 per cent. The three fatalities in the first group are 3.4, 33.8 and 11.9 per cent. In the second group 2.4, 18.7 and 13.1 per cent. The fatalities of the vaccinated and of the unvaccinated follow the laws stated while the adverse excess, 1.2 in the total fatality, is too small for serious notice in view of the manner in which the table was constructed. Error, sortation theory +1.20; mitigation theory -13.10.

Statistics of Three Irish and Three English Hospitals. Grouped by
Dr. T. W. Grimshaw.]

TABLE VIII.

Locality	Hospital	Per Cent. Vaccinated	Vaccinated	Fatalities Unvaccinated	Total
	Cork Street-----	81.8	10.8	71.8	21.6
Dublin,	Hardwicke-----	83.7	11.2	78.6	20.0
Cork,	Cork-----	68.1	5.5	58.0	22.5
	London S. P-----	91.5	14.9	66.2	18.8
London,	Hampstead-----	79.4	11.4	51.2	19.4
	Homerton-----	67.0	5.9	37.7	16.3

The author of the paper from which the above data were taken attributes the heavy fatalities in the Irish hospitals to insanitary conditions, simply because he could think of no other reason why the fatality of the unvaccinated should reach 78 per cent. The analytical results are: most vaccinated group; per cent. vaccinated 85.60; fatalities, vaccinated 12.30, unvaccinated 72.22, general 20.13 per cent. For the least vaccinated group the figures are 71.50, 7.60, 48.93 and 19.40 per cent., respectively. The most

vaccinated group though it has fourteen more vaccinated shows the higher fatality in all of the classes.

Errors, sortation theory $-.73$, mitigation theory -9.18 , or about thirteen times as large.

Dr. Grimshaw, commenting on his statistics, says: "The difference in total mortality between the Cork Street and Hardwicke hospitals might at first seem remarkable, the former being higher than the latter; but it will be seen that in *each* class the Cork Street mortality is lower than is the Hardwicke. The apparent difference is caused by the vaccinated cases being more numerous (83.7 per cent.) in the latter than in the former (81.8 per cent.)"

It is evident that Dr. Grimshaw clearly recognized the fact that the total fatality should fall as the per cent. vaccinated increased and he used the fact to explain why the hospital in his charge had a higher fatality than another hospital in the same city. He was on the right track but did not pursue it, or perhaps his inquiries along this line did not pan out as he expected and he lost all interest in the matter.

A glance at the table must have shown him that the hospital having the highest fatality and the hospital having the lowest fatality are more nearly alike in the number of vaccinated than any other two hospitals in the entire group.

An Analysis of 11,817 Cases of Smallpox Occurring in Twenty-six British Towns. Grouped by Mr. Ernest Hart in Allbutt's Practice of Medicine.

TABLE IX.

Locality	Year	Cases	Per Cent.	Fatalities		Total
			Vaccinated	Vaccinated	Unvac'd	
Sheffield -----	1888	4,677	88.24	4.85	49.82	10.13
" -----	1893	102	83.33	3.53	5.88	3.92
Warrenton -----	1893	598	88.63	6.04	41.18	10.03
Halifax -----	1892-3	513	82.84	1.88	40.91	8.58
Blackburn -----	1893	79	89.37	2.82	75.00	10.13
Bradford -----	1892	25	88.00	9.09	66.00	16.00
Brighouse -----	1893	23	86.96	10.00	0.00	8.70
" -----	1892	134	82.09	5.46	37.50	11.19
Glasgow -----	1892-3	259	95.75	4.44	63.64	6.95

Liverpool	-----	1892	194	87.62	3.53	37.50	7.73
Manchester	-----	1892-3	378	88.88	4.17	19.05	5.82
Ossetts	-----	1892	19	94.74	0.00	100.00	5.26
"	-----	1893	26	84.46	0.00	0.00	0.00
Salford	-----	1893	174	93.10	5.52	30.95	12.06
Swansea	-----	1893	25	95.65	0.00	100.00	4.35
Sheffield	-----	1892	47	78.72	5.41	10.00	6.38
Leicester	-----	1892-3	357	55.74	1.01	12.03	5.88
Dewsbury	-----	1892-3	1,012	63.83	2.79	25.14	10.87
Gloucester	-----	1895-6	1,979	61.19	9.91	40.89	21.93
Oldham	-----	1893	605	73.72	4.26	27.67	10.41
Bolton	-----	1893	44	70.45	3.23	38.46	13.64
Derby	-----	1893	46	69.57	6.25	35.71	15.22
Hastings	-----	1894	86	77.91	4.48	31.58	10.47
Huddersfield	---	1893	48	72.92	1.00	15.39	4.17
Keighley	-----	1893	72	43.05	3.23	14.63	9.72
Middleton	-----	1893	22	59.09	0.00	22.22	9.09
"	-----	1894	34	73.53	4.00	33.33	11.76
Pudsey	-----	1893	17	76.47	0.00	50.00	5.88
Southampton	---	1895	52	76.32	0.00	22.22	5.26
York	-----	1893	72	80.56	6.09	21.43	9.72

Mr. Hart was a strong partisan and a zealous advocate of vaccination. The analysis shows that the most vaccinated group was "protected" up to 88.68 per cent., while the least vaccinated group had only 68.87 per cent., or within a very narrow margin, twenty fewer "protected" per one hundred cases of the disease. The fatalities in the first group were 4.09, 44.50 and 8.06. In the second group they were 3.43, 26.71 and 10.03. Error sortation theory +1.97, mitigation theory -6.04 or rather more than three times as large.

Analysis of 20,736 Cases of Smallpox Occurring in Eight British Hospitals.

Grouped by Mr. Alexander Wheeler.⁴

TABLE X.

Hospital	Year	Cases	Per Cent.	Fatalities		Total
			Vaccinated	Vaccinated	Unvac'd	
Highgate -----	1836-51	5,748	54	8.66	37.53	21.9
Homerton -----	1871-77	5,479	77.31	11.69	45.85	19.43
Hampstead ----	1876-78	3,353	74.73	9.62	46.87	18.80
Fulham -----	1877-79	1,663	77.51	7.60	47.06	16.47
Deptford -----	1879	1,634	84.21	11.70	46.90	17.4
Dublin -----	1876-80	2,404	81.11	12.01	59.02	21.7
Gateshead -----	1882-83	177	72.32	9.38	36.73	16.9
Sheffield -----	1884	203	75.86	4.55	28.57	10.3
Newcastle -----	1883	253	79.45	9.45	34.61	14.6

The hospital returns from which the above table was constructed were placed before the Royal Commission on Vaccination by a strong opponent of the practice. The reader who wishes to know the truth should keep this in mind, and also remember that five of the tables considered in this chapter were fashioned by strong advocates of the mystic rite.

The analytical results are: Most vaccinated group, per cent. vaccinated 80.57; fatalities 10.19, 46.80 and 17.60. For the least vaccinated group the figures are 70.47, 8.63, 39.70 and 17.54. Error sortation theory $-.06$, mitigation theory -3.97 or about 66 times as large.

Examination of the Statistics of 11,099 Cases of Smallpox Occurring in Six Towns. Grouped by the Royal Commission on Vaccination.⁵

TABLE XI.

Towns	Cases	Per Cent. Vaccinated	Vaccinated	Fatalities Unvaccinated	Total
Sheffield -----	4 737	88.26	4.82	49.64	10.08
London -----	2,353	74.50	2.23	23.83	7.73
Dewsbury ---	1,012	61.36	2.58	24.04	10.87
Warrington --	661	89.71	6.41	35.29	9.38
Leicester ----	357	55.74	1.00	12.03	5.88
Gloucester ---	1,979	61.19	9.91	40.89	21.93

Analytical results. Most vaccinated group: per cent vaccinated 84.16. Fatalities 4.49, 36.25 and 9.06. For the least vaccinated group the figures are 59.43, 4.50, 25.14 and 12.89. Error, sortation theory $+3.83$, mitigation theory -4.02 .

Statistical Examination of 15,232 Cases of Smallpox Occurring in Six Towns, Epidemic Period of 1900-04. Grouped by the Author.

TABLE XII.

Towns	Cases	Per Cent. Vaccinated	Vaccinated	Fatalities Unvaccinated	Total
Liverpool ----	2,060	79.32	3.06	23.71	7.33
Leicester ----	715	44.90	1.56	6.17	3.50
London -----	9,659	76.42	11.73	33.06	16.87
Dewsbury ---	557	50.50	5.26	17.53	11.67
Glasgow -----	1,810	90.72	9.13	52.38	11.77
Orsettts -----	431	69.61	3.64	27.72	10.21

Analytical results. Per cent. vaccinated in most vaccinated group 82.15. Fatalities 7.97, 36.38 and 11.99. For the least vaccinated group the figures are 55.00, 3.49, 17.14 and 8.46. Error sortation theory — 3.53; mitigation theory — 11.24.

Summary of Errors or Deviations from the Predicated Results, Sortation and Mitigation Theories in Eight of the Preceding Tables.

TABLE XIII.

Tables	Sortation Theory		Mitigation Theory	
	Plus	Minus	Plus	Minus
III -----		.03		4.87
VI -----	2.19			4.41
VII -----	1.20			13.10
VIII -----		.73		9.18
IX -----	1.97			6.04
X -----		.06		3.97
XI -----	3.83			4.02
XII -----		3.58		11.24
Error Sortation Theory	+.60		Mitigation Theory	-7.11

The results of the eight statistical experiments would seem to indicate that vaccination possesses very nearly one-twelfth of the mitigating power claimed for it by vaccinators. But every statistical primary here used was collated by a believer. They all knew that a well-vaccinated group should have a low fatality, and conversely, a poorly vaccinated group should have a high fatality and naturally the hospital returns that favored their contention were the most advertised and used. Table x. furnishes a good illustration of this subconscious manipulation. Mr. Hart's table shows a manipulation of a different type. In Manchester, a well-vaccinated place, the total cases were 406 instead of 378. The "doubtful" cases, 27 in number, with five deaths and one re-vaccinated case, were stricken out. This reduced the total fatality by 0.83 per cent. In Gloucester, a poorly-vaccinated town, the total cases appear to have included 40 "doubtful" with 16 deaths. To what extent tendencies like these affected the results obtained it is impossible to say.

The possible psychic effect of vaccination should also be considered. When Friedman's turtle serum for tuberculosis was under investigation this factor was always kept in view. The members of Doctor Wiley's "poison squad" knew not who were taking the preserved foods and who were not. Of twelve medical students who took sugar of milk under the belief that it was cardiac medicine eleven showed marked effects on the pulse. Of seventeen students who took doses of the same substance all but one responded to the suggestion that the respiration would be affected. Taken as a class the vaccinated are undoubtedly the more hopeful when suffering from smallpox. It has not been positively shown here that the beneficial effect of vaccination is simply that of an amulet nor has it been shown elsewhere that it has any other effect. However, if it is granted that it has one-twelfth of its alleged potency that would hardly justify compulsion.

Several statistical tables illustrating some of the different ways by which the two competing theories may be tested will now be given and analyzed.

Duo-Ratio Analysis.

Showing the Percentage of Deaths from Smallpox Among Vaccinated and Unvaccinated in Various Places in Different Years. (From the

Deitschrift des Konigl. Preuss. Stat. Bureau

*Jahrgang xiii, p. 155).*⁶

TABLE XIV.

Places	Years	For every 100 Vaccinated	For every 100 Unvaccinated
France -----	1816-41	1.0	16.2
Marseilles -----	1828	1.0	25.0
Wurtembury -----	1831-35	7.1	27.3
" -----	1840-50	3.5	38.9
Canton of Waadt -----	1825-29	2.1	24.0
Bohemia -----	1835-55	5.1	29.8
Milan -----	1830-51	7.6	38.3
Verona -----	1828-39	5.6	46.6
Breslau -----	1831-33	2.1	53.8
Copenhagen -----	1828-37	1.0	27.6
Vienna Hospital -----	1837-56	5.0	30.0

"	"	-----	1859	3.8	13.8
"	"	-----	1870	2.0	17.4
Prague Children's Hospital		-----	1840-58	3.0	32.0
London Smallpox	"	-----	1836-56	7.0	35.0
"	"	-----	1863	12.0	48.0
"	"	-----	1864	8.7	36.0
"	"	-----	1865	7.4	38.0
"	"	-----	1866	7.3	35.7
"	"	-----	1867	8.29	36.8
"	"	-----	1868	6.2	34.0
"	"	-----	1870	7.9	38.5
"	"	-----	1871	14.9	66.5
Poland		-----	1871	11.41	32.95
Frankfort Town		-----	1871	16.0	49.0
"	"	-----	1872	16.6	46.0
Frankfort Govt. District		-----	1871	14.8	43.36
Liverpool Smallpox Hospital		-----	1870	12.73	72.0
Berlin Lazaretto		-----	1871-72	14.07	81.25
Coblentz		-----	1871	18.03	56.89

This much-used table was cited by Dr. Hopkirk before the R. C. on V. to illustrate the mitigating power of vaccination. I adduce it to show that the fatalities of the vaccinated and of the unvaccinated increase as the proportion vaccinated increases in communities. Dividing the table into halves with 15 primaries in each we find that in the 1st period, all of the observations, with one exception, having been made before 1860 the fatalities range in the vaccinated from 1 to 7.6 per cent. and in the unvaccinated from 13.8 to 53.8 per cent. In the 2nd all the observations having been made later than 1860 the fatalities of the vaccinated range from 6.2 to 18.03 per cent. and those of the unvaccinated from 32.95 to 81.25 per cent. The averages are: 1st group; vaccinated 3.63, unvaccinated 30.4 per cent. 2nd group; vaccinated 11.76, unvaccinated 47.66 per cent. This shows an increase in the vaccinated of 8 and in the unvaccinated of 18 deaths in one hundred cases. If, however, we had the total deaths before us we should find that the alleged increase in the fatality of the disease was wholly on paper.

Dr. Hopkirk was asked: "Do you wish the Commission to draw any conclusion from these varying percentages among the

vaccinated?" He replied: "The only conclusion that I can draw from the table itself as a whole is that it shows most distinctly the value of vaccination." Then Dr. Collins said: "I ask you whether you think that the considerable variation from 1 to 1.8 per cent. amongst the vaccinated calls for any particular explanation from you." The answer was: "The only explanation to be given for it is that there must have been a great deal of difference in the nature of the vaccination performed." If this explanation is correct then the vaccinators were steadily losing skill and ability for a half century or more while having an enormous increase in practice. Another puzzled expert.

Mono-Ratio Analysis.⁷

TABLE XV.

Years	Place	Cases	Vaccinated Cases	P. C. Vaccinated	Deaths	P. C. of Deaths
1823-24,	Philadelphia ---	235	64	27.23	92	27
1871	" ----	1,189	799	67.20	382	32.13
1872	" ----	1,137	830	73.00	342	30.08
1873	" ----	36	28	77.78	9	25.00
1874	" ----	16	8	50.00	5	31.25
1875	" ----	48	31	64.58	17	35.45
1859-60	Boston -----	97	30	30.93	14	14.43
1877	San Francisco--	875	234	26.74	245	28.00
1881	New York-----	166	86	51.81	48	28.92
1884-85	Montreal -----	1,332	527	39.36	418	31.38

The above table was compiled by and placed in evidence before the R. C. by a Mr. Alexander Wheeler, an active English opponent of vaccination. His avowed purpose was to show that vaccination does not mitigate smallpox. But as it is plain that he did not foresee the present use of his labors the table may be properly considered fortuitous as far as this study goes.

It is evident that the first primary in the table is to some extent erroneous, as the fatality would be if otherwise correct, 39.15 per cent. Upon looking up the matter, it appears that the line should read, cases 248, deaths 92, fatality 37.10 per cent. The table is used with this correction. The analytical results are:

Per cent. vaccinated; most vaccinated group 66.87; least vaccinated group 34.89. Fatalities: most vaccinated group 30.32 per cent.; least vaccinated group 28.84 per cent. Error sortation theory -1.48 . If we may assume that the difference in the fatalities of the vaccinated and of the unvaccinated was the same as that observed in the Municipal Hospital in 1871-72 and this hospital furnished the larger proportion of the cases in the most vaccinated group, then the error, mitigation theory would be -16.06 per cent.

The Salvage Ratio.⁸

TABLE XVI.

District or Hospital	Proportion of Recoveries Amongst		Differences
	Vaccinated	Unvaccinated	
Sheffield -----	0.952	0.504	0.448
Leicester -----	0.990	0.880	0.110
Homerton and Fulham -----	0.922	0.564	0.358

This table was constructed by a lay statistician of repute who believed in vaccination and was trying to solve some of the related problems. Necessarily he became puzzled. They all get that way. He did not understand why vaccination seemed of so little use in Leicester, but supposed the disease was lighter there. This was correct and was a partial explanation of the low salvage in that unvaccinated center. Looking up the matter it appears that the per cent. vaccinated in the Leicester cases was 55.74, in Fulham and Homerton hospitals 77.88 and in Sheffield 82.26. The apparent salvages were 110, 358 and 448 per 1,000 cases, respectively. These results are strictly in accordance with the sortation theory.

The fatality of the vaccinated and of the unvaccinated increases as the per cent. vaccinated increases. The proportional increase is the greater in the vaccinated but the absolute increase is the greater among unvaccinated. The supposed but wholly imaginary mitigation increases as the per cent. vaccinated increases. Let us suppose an epidemic of smallpox with a fatality of 20 per cent. One group of 1,000 patients has 960 vaccinated.

The probable distribution of deaths would be 170 among the vaccinated, a fatality of 17.70 per cent. Among the unvaccinated we should expect 30 deaths or 7.5 per cent. This would give an apparent saving of 573 lives in 1,000 cases. Reverse the proportions and the 960 vaccinated would have about 199 deaths, a fatality of 20.73 per cent., the 40 vaccinated cases would have one death or 2.50 per cent., the apparent saving in lives being only 182 in 1,000 cases. We have here an added way of testing the two competing theories.

Showing the Relation of the German and the Irish in Philadelphia to Smallpox in the Epidemic of 1871-2.

TABLE XVII.

	Total	German	Irish
Foreign Population.....	183,624	50,746	96,698
Percentage		28%	53%
Foreign Patients in Hospital.....	928	518	265
Percentage		58%	29%
Foreign Deaths in Hospital.....	220	79	104
Percentage		36%	47%

From this table it appears that the Germans had nearly four times as many cases of smallpox in proportion to their population as the Irish and nearly 50 per cent. more deaths proportionately. This exceptional liability of the Germans to smallpox was not local. Mr. Amasa Walker found, not from hospital returns, but from data obtained from the census taken in 1870, that the Germans furnished 58 in each 1,000 deaths from smallpox, though they were numerically entitled to only 44, while the Irish furnished but 27 though numerically entitled to 48. The Germans exceeded their proportion nearly one-third while the Irish fell short of their proportion much more than a third. Mr. Walker, commenting on his figures, says: "Among the Germans," "a decided liability to those, especially smallpox of the Febrile Group (being an exact reversal of the Irish thereto)."

Mr. Walker also found that though the Germans were especially liable to smallpox their death-rate from all causes was very low, very much lower indeed, than that of the Irish. Only 38 Ger-

mans died when their proportion was 44. Of the Irish 55 died when their proportion was 48. What was the vaccinal condition of the Germans? Dr. W. M. Welch, in charge of the Municipal Hospital, classed as vaccinated only those who had visible marks on their arms. Something over 92 per cent. of the Germans were thus marked and many claimed to have been vaccinated on other parts of the body. For obvious reasons a considerable number of German women are scarred on the leg instead of the arm. These, of course, were classed as unvaccinated.

Dr. Conrad, resident physician of the Marine Hospital at Baltimore, during the same epidemic, states: "No nation on the globe has such rigid laws of compulsory vaccination, and no people are so thoroughly vaccinated, almost everyone presenting from one to eight and even sixteen vaccine marks (done in infancy) and yet it is astonishing the number with even dangerous forms of the disease, in many cases unmodified altogether."

"The Negro who had but rarely more than one mark, and that generally imperfect (also done in infancy) *had a less degree of variola* than the Germans with all their vaccine marks. In truth the observation forced itself upon me that one imperfect mark in the Negro (done in Childhood) was more protective to him than the many found on the arms of the Germans done at the same time.."

REFERENCES.

- 1 Acute Contagious Diseases, Phila., 1915.
- 2 Vaccination, A Prize Essay, Lond., 1868.
- 3 Dublin Med. Journal, 1879.
- 4 Royal Commission on Vaccination. 3rd Report.
- 5 " " " " Final "
- 6 " " " " 2nd "
- 7 " " " " 6th "
- 8 Yule.

CHAPTER VI.

Decadal Immunity.

The theory that the influence of vaccination wears out and that revaccination is essential to its continuance has been held generally by the members of the medical profession for about three quarters of a century. It is an obvious corollary of this theory that recent vaccinees should have smallpox not only less frequently but also less fatally than those whose vaccination could not be classed as recent. To support this contention it has been the practice for many years in our smallpox hospitals to divide the patients into age classes. For a long time, however, there was no uniformity in the age periods selected and apparently no purposed use of the data that would interfere with the proper classification of patients whose age was only approximately known. After the passage of the German law in 1874 making revaccination compulsory at the age of twelve years the English vaccinators, anxious to secure a similar law for England, began to furnish statistical evidence of its necessity. With great uniformity the hospital superintendents sought to show that up to the age of ten years the vaccinated child was almost absolutely safe from death by smallpox, and that the unvaccinated child nearly always had the disease in a very severe form and with great danger to life. Whether selected for this reason or not the divisional period was a very favorable one. Patients "about" so old are always quite numerous, but they are especially so at the decadal and the quinquennial periods of life.

Under the comparatively favorable circumstances of the census inquiries great difficulty is experienced in getting accurate age returns. In Massachusetts, certainly a well-educated community, there were returned in 1885 a total of 78,364 inhabitants of the ages 39, 40 and 41 years. Those of 40 years should have constituted just about one-third of the total or in round figures 26,000. The actual number returned was 38,381, an excess of 12,000 or 46 per cent. The figures for those aged 39 were 21,972, about

4,000 too few, while the number for aged 41 was 18,061, an error of about 7,000. In India, where great ignorance prevails, there has been found in 100,000 of all ages 322, 39 years old; 5,240, 40 years old, and 216, 41 years old. This difficulty is present at all decadal periods. The general character of the smallpox patients and the circumstances attending their removal to the hospitals are markedly unfavorable to accuracy in the knowledge of the ages of the patients. As a result the doctors in charge have to use their judgment in many cases as to the real age of the patient. Errors will necessarily follow, but when there is no perturbing bias the errors will probably balance each other in the long run. In the matter of decadal immunity there is much of bias and it is evident that to a large extent when the patient is about ten years of age the fixing of his record age will depend upon his vaccinal condition and the character or the result of the attack. With the necessity of making what purports to be an exact classification with very inexact knowledge, class and educational bias will be potential factors. If the child is vaccinated, and the case severe and dangerous it must be over ten because under that age the cases are always mild, usually of the varioloid type. Conversely, if the child is unvaccinated and the disease mild the presumption is that it is over ten. If the child is vaccinated and the disease mild then the child is under ten for the chances are strongly that way from the vaccinator's viewpoint. It is not meant that the statistics are purposely manipulated in the manner stated but only where exact information is lacking and a decision imperative errors of the kind indicated are inevitable and the fact that the hospital superintendents are silent in regard to this ever-present difficulty is very good evidence that they do not regard their solution of the problem as likely to be satisfactory to sceptics.

It needs no statistical Sherlock Holmes to see that if these conjectures are sound there would be of necessity a robbing of Peter to pay Paul. In the preceding chapter we found that the average fatality of compared groups was not affected by variations in the proportion vaccinated. Normally this should also be

true if we compared age classes in the same manner, but we shall find when we analyze the statistical data that vaccination appears to benefit those under ten years of age, to injure those above that age and to be without effect when groups embracing all ages are studied.

Before examining the statistics designed to show that vaccinated children under ten years of age rarely die of smallpox when attacked by the disease it will be proper to show that prior to the passage of the German law no similar immunity was alleged to exist in Germany or in other countries.

Cases of Deaths of Smallpox in Vaccinated Children in Berlin in 1871-72.

TABLE XVIII.

Ages	Cases	Deaths	Fatalities
0-1-----	259	136	52.5
2-5-----	1,244	437	35.1
6-10-----	737	163	22.1
Totals-----	2,240	736	32.86

By this table it appears that the older the child, and consequently of the vaccination, the milder the smallpox. More than half of the sick yearlings died of the mitigated disease. At that time German vaccinations if not peerless in quantity and quality were at least the equal of the best. If we widen the period the fatality falls. In the period 1865-74 there were 3,970 cases under ten years of age with 999 deaths or 25 per cent.

In the Vienna General Hospital during the years 1836-56 there were among the vaccinated under ten years of age 234 cases of smallpox with 35 deaths, a fatality of 15 per cent. A very large number of the cases in the hospital were classed as varicella and doubtless many were chickenpox and this tended to keep the fatality low, especially among children.

In the Metropolitan Asylums Board Hospital in London there were in 1870-72, 981 cases of smallpox in vaccinated children under ten years of age, with 98 deaths or 10 per cent. fatality.

In the Cork Union Workhouse up to September 1872, there were 147 of these cases with 16 deaths or 11 per cent.

In Riverside Hospital in New York in 1875 the cases in the class under consideration were 121 with 38 deaths or 31 per cent. These include all of the cases that I could readily find. Statistics of this kind became more abundant in later years when professional philanthropy conducted on war principles sought to show that revaccination at the age of ten would abolish smallpox.

**Showing the Opposed Results Found When Studying the Relation of
Vaccination to Confluent Smallpox.**

TABLE XIX.

	Under 10 years of age		Over 10 years of age		All ages	
	Per cent. unvac- cinated	Per cent. confluent cases	Per cent. unvac- cinated	Per cent. confluent cases	Per cent. unvac- cinated	Per cent. confluent cases
Warrington ----	49.23	38.46	6.04	25.50	10.28	26.77
Dewsbury -----	79.16	44.44	24.36	22.22	36.16	26.98
Leicester -----	98.16	49.54	20.56	16.93	44.25	26.89

Of the six towns reported on by the Royal Commission only four furnished data such as are embodied in the above table. In order to show that the vaccinal gain and loss just balanced it was necessary to restrict the inquiry to three towns where the epidemic severity was of a similar grade when measured by the per cent. of confluent cases present at all ages. Looking at the two columns at the left the conclusion would seem warranted that the unvaccinated children had about 50 per cent. of confluent cases and the vaccinated about 25 per cent. Certainly a marked benefit. The central columns appear to show that a wholly vaccinated group would have about 22 per cent. of the confluent cases and a wholly unvaccinated group would have none. A marked injury by vaccination. The two columns at the right show that whether there are 90, 64 or 56 per cent. vaccinated the proportion of confluent cases remains unaffected.

Showing the Gain and Loss Feature in the Six Towns Grouped by the Royal Commission.

TABLE XX.

	Cases	P. C. Vacci- nated	Vacci- nated	Fatalities Unvac- cinated	Total
Under 10 years of age,					
Most vaccinated group-----	1,064	49.40	1.61	35.24	18.63
Under 10 years of age,					
Least vaccinated group-----	1,034	7.06	2.78	36.28	34.04
Over 10 years of age,					
Most vaccinated group-----	5,965	92.52	6.36	49.55	9.56
Over 10 years of age,					
Least vaccinated group-----	3,036	78.07	2.37	19.50	5.73

ERRORS.

Under 10 years of age, Sortation Theory-----	+ 15.41
Under 10 years of age, Mitigation Theory-----	+ 1.17
Over 10 years of age, Sortation Theory-----	- 3.83
Over 10 years of age, Mitigation Theory-----	- 10.07

Showing the Gain and Loss Feature in the Towns Grouped by Mr. Earnest Hart.

TABLE XXI.

	Cases	P. C. Vacci- nated	Vacci- nated	Fatalities Unvac- cinated	Total
Under 10 years of age,					
Most vaccinated group-----	792	58.96	1.71	44.00	19.07
Under 10 years of age,					
Least vaccinated group-----	1,325	8.15	1.85	34.34	31.69
Over 10 years of age,					
Most vaccinated group-----	7,439	92.86	5.76	48.78	8.33
Over 10 years of age,					
Least vaccinated group-----	2,279	80.74	3.26	19.13	6.32

ERRORS.

Under 10 years of age, Sortation Theory-----	+ 12.62
Under 10 years of age, Mitigation Theory-----	- 8.87
Over 10 years of age, Sortation Theory-----	- 2.01
Over 10 years of age, Mitigation Theory-----	- 7.22

In the last two tables the apparent gain by the neglect of vaccination looks at first sight to be much less than the loss. This is due to the fact that the over-ten-years-of-age-class contains

9,000 or more cases, while the groups of younger patients contain about 2,100. In these tables the all-ages statistics have been omitted because they were dealt with in the preceding chapter. In common, however, with Table xix these two show that if the phenomena commonly attributed to vaccination are really due to that cause then vaccination saves a lot of lives in children under ten years of age and causes a balancing loss of lives in persons above that age. No one, of course, believes that and the only possible solution of the puzzle is that the hospital statistics are grossly manipulated. If these results are due to the efforts of the English hospital superintendents to aid in securing a revaccination law then if we could find material for a similar table the data gathered before the campaign for revaccination commenced, the gain and loss phenomena should be largely if not wholly absent. I have no knowledge of the requisite data. They may exist in England.

In Chapter v. in every case the error, mitigation theory was larger than the error sortation theory, and also it was always a minus error. In the two preceding tables, in the under-the-ten-years-of-age-class, this feature is reversed and the error, sortation theory, is the larger. In one table it is thirteen times larger than the mitigation error. In both tables it is a plus error. But when we take the over-ten-years-of-age-class the error, sortation theory, is much smaller, and in both cases a minus error, making it appear in the absence of any better explanation, that the alleged remarkable exemption of young vaccinees is wholly illusory and is the result of biased observation and partisan statistics.

REFERENCE.

- 1 Tebb, *Century of Vaccination.*

CHAPTER VII.

Varioloid and Allied Topics. Origin and Meaning of Term.

It is a very obvious deduction from the sortation theory that a form of smallpox favorably modified by vaccination is a myth, and that the so-called varioloid is simply the milder forms of the disease occurring most frequently among the vaccinated because of the sortation or manipulation present.

When it could no longer be denied that smallpox occurred after vaccination the term "varioloid," meaning like, but not the same as "variola," was coined to cover such cases. The misleading character of the term is now universally admitted, and modified variola or *variola modificata* has been authoritatively substituted. But the old word sticks as tenaciously as the thirteen superstitions, and the new name retains the old error. By varioloid we denote smallpox which in all its stages, or in all but the first stage, runs a shortened course. An abortive form is not peculiar to smallpox. It is a feature of all diseases and probably forms a pretty constant proportion in each, approximately one-third. It is simply an ordinary manifestation of the variations of vital phenomena in disease, so inseparable from evolution. The extent of these variations is well shown in the familiar fever and ague. In the algid stage you may have only the blanching of a little finger, or a shivering that shakes the bed, the furniture and even the windows of the room. In the sweating stage the variations are as well marked. You may have a barely perceptible moisture or a drenching perspiration. The Asiatic cholera poison will purge, shrivel and kill one person in a few hours and act as a beneficent laxative in another. Of yellow fever an early observer says of some mild cases: "The contagion acted in these cases like a cup of strong tea or small quantity of wine."¹

In typhoid, typhus and cerebro-spinal fever the abortive attacks are commonly described under that term, while influenza has a "rudimentary" form and scarlet fever a "benign" type.

Of the abortive form in typhoid fever Wilson writes: "The parallelism between these cases as compared with typical enteric fever, and varioloid compared with variola is complete."² He, however, considers this form rare in this country though not uncommon in Europe. Epidemics have been reported with 25 per cent. of abortive or very mild cases. The tendency of improved diagnosis is to increase the proportion of such cases. Dr. Briggs, who has given much attention to the subject, thinks Wilson has under-rated the frequency of these cases in this country. In his own experience 5 out of 17 cases were "mild and abortive."³

Apart from smallpox, writers have given but little attention to the relative proportions of mild and severe cases. A Dublin hospital⁴ reports 73 cases of mild scarlet fever out of a total of 105 or 69.52 per cent. with no deaths. The remaining cases had 23 deaths, a fatality of 21.90 per cent. for the whole number, which shows that it was not a mild series. Some diphtheria statistics give similar results but as the patients were treated either in whole or in part with antitoxin they cannot be used here.

Varioloid in Prevaccinal Times. Method of Investigation.

From the time of Sydenham the division of smallpox cases into discrete or distinct and confluent has been more or less in vogue. We are able, therefore, to make comparisons on these lines, and if we find that the proportion of distinct cases, varioloid included, has not increased since the resort to vaccination, we will be justified in inferring that the varioloid cases have not increased or else that the distinct cases have decreased in proportion to the increase in varioloid.

The claim that vaccination increases the proportion of distinct cases, will of course, be tested by the same inquiry. The facts to be given will show clearly that in the opinion of the most authoritative medical writers of the 17th and 18th centuries distinct smallpox formed at least two-thirds of all cases of that disease, and that cases of the type now known as varioloid formed fully one-half of the distinct cases. The latter claim will be estab-

lished by comparing the characteristics of varioloid with those of distinct smallpox as described by early writers.

On the Relative Frequency of Confluent and Distinct Smallpox in Prevaccinal Times.

Fuller, whose treatise is very extensive and contains many references to the older authors, writes as to this topic: "It seems to me that the confluent smallpox was not much known to our forefathers, and though there were some hints of it sprinkled about in some authors, yet none ever handled it distinctly and exp^oresso till our great Sydenham did it."⁵

Sydenham's own writings give nothing more definite than this: "I will own that sometimes smallpox will become confluent under any treatment." But Dr. Cole, a correspondent, writes: "When I was called to persons afflicted with confluent smallpox (which, however, seldom happened) I scrupled not upon your authority to have recourse to opiates."⁶

The successful treatment of smallpox claimed by the most reputable physicians, coupled with the acknowledgment of great danger in confluent cases, shows that such cases were probably not more frequent proportionately than at present. Sydenham, while admitting that confluent cases "are always dangerous," asserts as to smallpox in general: "The disease is a slight one. The ignorance of the physicians who aim at nothing so much as the promotion of heat can alone make it dangerous." Again, writing to Boyle, he states: "If no mischief be done by physician or nurse smallpox is the most light and safe of all diseases."

According to Lynn, Dr. Mapletost, a "crony and contemporary" of Sydenham and at one time president of the College of Physicians, treated cases of smallpox for six years without losing a case. "He very frankly told me," says Lynn, "his general way was to do nothing at all."⁶ Later Mapletost lost two or three patients with smallpox which so disheartened him that he abandoned the practice of physic and gave his talents to the church.

Lynn was an advocate of the expectant practice and severe on doctors generally and while his narrative seems incredible, it is to be remembered that he claims to have received his information direct and that Mapletost was living when Lynn's work was published and that Lynn thought Mapletost's success exceptionable. The eminent Baglivi claimed a similar low fatality.

He describes his treatment of inflammatory fevers including smallpox and adds, "When I pursued this method I never had a patient ill of smallpox that died under my hands."⁷

With the advancing knowledge of the 18th century the testimonies became more explicit. Thus Blackmore asserts: "It is plain then that the safe and distinct kind far exceeding in number the dangerous and confluent shows that the materials of the smallpox are at first gentle and benign."⁸ Another London physician writes: "I seldom administer any remedies in the smallpox if they be of the benign kind, if I see nature (as most commonly she is) is able to overcome the disease herself."⁹

In a standard treatise published about the middle of last century we read: "The mortality in smallpox of the simply confluent is computed to be about three in five; but of every six persons who receive smallpox in the natural way one dies in general."¹⁰ This statement presumably represents the common medical opinion of that time. With the advent of Marson teachings of this kind were summarily abandoned and it has been ever since persistently taught that the severity and fatality of prevaccinal smallpox should be determined by a study of the rates in the unvaccinated at the present time, the so-called "natural" smallpox.

If the statement of Thomas was correct the proportion of confluent cases could not have been estimated at more than 25 per cent. If we assume 28 per cent. of confluent cases then the 72 per cent. of distinct cases could have had no deaths. If we assume that the distinct cases died at the rate of 4 per cent., which was Marson's hospital experience, then the proportion of confluent cases must recede to 25 per cent. Again the calculation refers

to the "simply confluent," and as there were probably some malignant cases with a still higher fatality the estimated proportion of distinct cases must be still further increased. These calculations are based on the assumption that the estimate of one death to every six cases of the disease was correct. It certainly was in accordance with the general medical opinion at the time. But even if we accept the radical pro-vaccinal claim of a 30 per cent. fatality, 50 per cent. of confluent cases would furnish the required deaths and make necessary 50 per cent. of distinct cases. I consider it proven that the claim that vaccination has increased or has been associated even accidentally with an increase in distinct cases of smallpox, varioloid included, is without historical foundation.

We will now learn what we can in regard to the proportion of distinct cases that were what we now term varioloid.

Characteristics of Varioloid and of Prevaccinal Distinct Smallpox Compared.

The following, taken from Niemeyer,¹¹ is the fullest and most explicit statement of the distinguishing features of varioloid that I have ever seen.

"If we group the peculiarities that distinguish varioloid from variola we shall mention especially; 1, The short duration of the different stages and of the entire disease; 2, The mildness or total absence of the secondary fever; 3, The escape of the cutaneous tissue and the recovery without cicatrices; 4, The slight mortality.

The Shortened Duration of the Disease.

"The more benign the disease is the sooner all its periods (except the first) are completed and on the contrary the more violent, the longer are all its stages except the first."¹²

"Some of them appear quickly and are soon suppurated, and these are such as are of the distinct sort which I have omitted to speak of here because they are only nurses' work."¹³

"Many children and even grown persons have had them in the natural way in so mild a manner that they had no perceptible fever, nor scarcely ailed anything previous to or during the course of them." ¹⁴ "The disorder is sometimes so very mild and slight that the eruption appears with scarcely any suspicion of the child having the least ailment, and the event is as favorable as the invasion. The pustules grow large, suppurate and attain their maturity without confining the patient to his bed or lessening either his sleep or appetite." ¹⁵

The Secondary Fever Mild or Absent.

"The second fever beginneth with the stage of maturation, namely, on the ninth day, and never happeneth in the distinct smallpox." ¹⁶ "The secondary fever seldom or never attends the distinct and rarely the contiguous sort." ¹⁷ "When the pustules ripen it is seldom that in the distinct smallpox the fever continueth longer." ¹⁸

"In the distinct smallpox there ensues little or no secondary fever but it regularly attends on the confluent."

"The simple distinct sort is commonly nothing but a salutary crisis wherein the fever and the symptoms immediately vanish after the eruption." ¹⁹

Recovery Without Cicatrices.

"The distinct smallpox very rarely leaves any marks behind it." ²⁰

"And if it were but for this reason only inoculation is greatly commendable for as much as it never occasions the second fever and consequently never leaves deformities." "For 'tis the heat and vehemence of that fever which actuates the virosity of the matter and causeth pits and scars." ²¹

The Slight Mortality (Fatality.).

"It is only when the distinct approaches to the circumstances of the confluent that it is attended with any danger." ²² "There

wants very little to be said on this kind of smallpox. I have heard of several but never had one that died in this case." ⁴³

"A natural, simple smallpox seldom kills unless under very ill-management." "I have long since shown in another place wherein the great difference consists between the distinct and confluent smallpox; namely, that the former is so void of danger as to stand in need of very little assistance from medicine, the patient recovering spontaneously by the help of nature unless he promotes a sweat in the beginning by lying down in bed." ⁴⁴

"Upon this account it is that a true regular distinct smallpox hath in its own nature little or no danger in it."

Varioloid in Primitive People.

Probably the best account of smallpox as it appears in a strictly primitive people has been given by Dr. Gullick, who was residing at the place, Ponapi or Ascension Island, at the time of the epidemic he describes. The natives numbered some 8,000, not one of whom had ever been vaccinated or had smallpox. The disease was introduced by the landing of two sick sailors from an infected vessel. All of the natives, living in huts, with the exception of about 500 who were inoculated, there being no vaccine virus available, took the disease. The fatality was placed at 50 per cent. It is a fair presumption, therefore, that the disease was at least of ordinary severity and with no unusual proportion of mild cases. Notwithstanding this severity the account states: "In perhaps one-third of all the cases we had what I must suppose to be identical with varioloid technically so-called, though no vaccination had preceded to modify, and in many instances we had what I could not distinguish from varicella and what I must term varicelloid." There were also cases "fading out at the second or third day after, terminating in a mere scurf." To show that these mild cases were really smallpox, the doctor continues; "I found them of every age. The mildest cases were also equally satisfactory with the most severe for having had the disease even in this mild way the individual was safe from a re-attack." ⁴⁵ The

great fatality among the natives is attributed to the want of cleanliness and of proper nourishment and the resort to the heating system of treatment in close huts. If among these dirty, ill-fed and improperly treated savages showing a fatality of 50 per cent. there were about one-third of the cases that would have been classed as varioloid if vaccinated, what would be the expected proportion in civilized communities at the present time, vaccination not taken into consideration?

The effect of improved methods of living and nursing on the severity of the disease is also noted. "It may be of interest to state that though there are about twenty-five foreign residents and though several had slight attacks, not one lost his life; nor did the native wife of any one of them die; nor did a single child of a resident white man by a native woman die though there are fifteen or more of them, a fact which must be attributed to the better nursing bestowed on such. It is also interesting that of the eight or ten children of non-resident whites by native women not one died."

A recent writer testifies in regard to another people, not strictly primitive, however, but who ignore vaccination. "Among the Mexicans a mild form of smallpox exists during an epidemic which they call white smallpox. This condition seems to me to be closely allied to the so-called varioloid setting in with abruptness and severity, continuing more mildly with few papules and no secondary fever. I have seen many such cases but the curious feature is there is no history of vaccination." ²⁶

In Santa Cruz, Cal., an epidemic disease attacked about one-half of the pupils in a school of about 60 children ranging in age from 5 to 16 years. The attending physician says: "It was characteristic of varioloid though none had ever been vaccinated." "

Varioloid in Soldiers.

American Army in the Philippines, September 3, 1898, to March 31, 1899. Cases of smallpox, 236; varioloid, 85; per cent.,

36.02. These soldiers were reputed to be the most carefully selected troops ever enlisted. For recentness and thoroughness their vaccinations have never been excelled. They were vaccinated at the Presidio before sailing and again while crossing the Pacific; yet they commenced contracting smallpox within four days of their landing in Manila. The enlisted men were of an age favorable to mildness in the disease. Rosenstein gives as "the most favorable age for a patient in the smallpox" from the fourth year to the fourteenth, and the next favorable one from the sixteenth to the twenty-fifth. Of the Ponapi Islanders, Gullick tells us "they all died at the extremes of life" and consequently they did not have varioloid, as it is a non-fatal type of the disease. Making a slight correction for the difference in ages it appears that the soldiers did not do any better if as well as the savages.

English Troops for the period 1834-38, inclusive. All vaccinated at the time of enlistment if not previously vaccinated or had smallpox. Few or no revaccinations. Home force: total cases of smallpox, 605; modified cases, 258; per cent. 42.64. Foreign service: total cases 420; modified cases, 154; per cent. 36.67.²⁸ Both bodies: total cases, 1,025; modified cases, 412; per cent., 40.20.

French prisoners captured and held at the French fort of Rocroi on the Belgian frontier in Franco-German war.²⁹ Total cases of smallpox, 44; vaccinated, 41; unvaccinated, 3. Varioloid cases, 20, 45.15 per cent. of the entire group, or 48.78 of the vaccinated. All of the vaccinations were done in infancy. There were 15 deaths, a fatality of 34 per cent., which shows that the disease was exceptionally severe, yet they had a higher percentage of varioloid cases than the English soldiers, many of whom were vaccinated at the time of enlistment, or the American soldiers, all of whom had been revaccinated one or more times within a year of their attack.

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CHAPTER VIII.

Genuine and Spurious Vaccinia. Importance of Bodily Condition.

The results of vaccination are far from uniform, and as the alleged beneficial effect of the operation confessedly varies with the results obtained, it follows that if the apparent superiority of the type of vaccinia termed genuine is due, as is here maintained, to sortation, then the variations by which vaccinators divide their results into "genuine and spurious," "perfect and imperfect," must be chiefly due to the condition of the patient and not to the skill of the operator, and further that the conditions that favor the production of the genuine or perfect vaccine disease are the conditions that favor mildness or discreteness in smallpox.

It is hardly to be expected that vaccinators will volunteer any information calculated to lessen the estimation in which their practice is held. But the vaccinated take smallpox and they die of the disease. These facts must be explained. It is then the vaccinators need and his ambition to tell the natural limitations to his success, to acknowledge that he, when producing his genuine disease, is the poor base almsman of contingency, and truths come out that are never mentioned when legislative committees are told how simple a matter it would be to protect the community if there were only sufficient compulsion and adequate fees. Cécily's recognition of the importance of bodily condition is at once emphatic and authoritative.

"It is quite allowable to admire, and perfectly right to endeavor to produce beautiful vesicles; but we must admit our failures in such attempts while relying on lymph alone; the soil is of as much importance as the seed. Lymph from the smallest vesicles, if normal, will in a good subject furnish in its turn the finest vesicles, and *vice versa*." Again, writing of the action of primary lymph, he says: "The color and extent of the areola, vary of course, in different subjects, being very florid and extensive in the sanguine and irritable; pale and limited in the leucophlegmatic and apathetic."

Mr. Badcock, another widely known purveyor of vaccine virus, urging the importance of good lymph and the necessity of skilled vaccinators capable of selecting good subjects from whom to take supplies, says: "For instance, if a given number of cottagers' children, plainly but sufficiently fed, be vaccinated from the same source and at the same time, with the same number of town-bred children and then examined at the expiration of the same interval afterwards the robust constitutions of the former will be at once distinguishable by the better development of the disease; consequently the former will be the best subjects for the selection of lymph. This I have had frequent opportunities of noticing."

In Jenner's opinion nothing was too insignificant to affect the course of the vaccine disease. He mentions a variety of causes but herpes was his hobby. Children fed on trash were likely to have vesicles on their lips and one vesicle was sufficient to derange the vaccinia and the protection was diminished in proportion to the derangement.

Bodily Condition Affecting the Character of Vaccinia and Smallpox Compared.

Vaccinia.

Variola.

HEALTH.

"It is a circumstance admitting of no doubt that the state of perfect health is the most congenial to the efficacy, beauty, and future progress of the vaccine vesicle and in proportion as the constitution of the individual vaccinated deviates from that state in the same proportion does the vaccine vesicle deviate from its beauty and efficacy." ³

"If the party infected be healthy at other times, clean, cool and hath not been heated by over-bad management and medicines, and nature be permitted to proceed in her own leisurely quiet way probably there will be but a small quantity of variolous matter assimilated and that which is will prove but a mild and weak sort of venom." ⁴

PLETHORA.

"In others, especially the strong and vigorous, I have known phlegmonous erysipelas not unfrequently to follow properly performed vaccination." ⁵

"Young, lusty, strong men that are full of hot blood and brisk spirits are liable to a bad confluent sort." ⁶

STATE OF THE SKIN.

"It is not the health and temperament alone of the subject, but the condition of the dermic tissues that determines the development of the vesicles." ⁷

"The inflammatory state of the whole system and more particularly the skin is the cause of the multiplication of the pustules." ⁸

THE DARK RACES.

"It is an opinion that has found its way into text-books that the dark races of mankind are less susceptible of the protective influence of vaccination than Europeans or rather I should say that the operation is more apt to fail of success." ⁹

"It is particularly destructive to the dark-skinned races, the blacks who come to the smallpox hospital suffer more from the disease than the native inhabitants of Great Britain. The same thing has been found to take place abroad." ¹⁰

CUTANEOUS DISORDERS.

"Mr. Sterry says he did not remember an instance of successful and perfect vaccination in a patient the subject of cutaneous disease." ¹¹

"Cutaneous disease of any kind existing to some extent the operation is inadmissible. Not easy is it in this state of the skin to get the virus to act and when it does it is apt to generate a mixed disease devoid of protective power." ¹²

"People who have had scabies, eczema, psoriasis, lichen or any exudative skin disease and are attacked with variola will almost always exhibit on the same spot this confluence of the pustules." ¹²

"Smallpox is readily confluent on those places where a chronic or acute inflammation exists: thus it is intensely confluent when occurring with eczema or when the latter is general and especially when it is moist the life of the patient is in great danger." ¹⁴

SICKLY CHILDREN.

"Those vaccinations which have been least satisfactory were such as have been performed upon sickly children or those that had eruptions." ¹⁷

"Infants who are puny and badly developed at birth are thus apt to furnish bad successes." ¹⁸

"Very dangerous to infants and delicate children."

"All individuals whose mucous membranes are predisposed are apt to have smallpox severely and hence its fatality among pale, puny children." ¹⁵

INTEMPERANCE.

"Individuals who are habitually intemperate in the indulgence of alcoholic liquids are especially unfavorable subjects for vaccination. The results are fortunately rarely serious to the patient." ¹⁹

"Draymen, barmen, postmen, tailors, and the women on the town are very unfavorable subjects to be attacked with smallpox owing to their habits of indulging freely and almost daily in strong drinks." ¹⁶

Objections Considered.

Readers acquainted with vaccinal apologies may suppose that I have substituted individual for professional opinion in some of the above citations. If I have done so it is unavoidable. The trouble is, the witnesses have opposing biases, and I am compelled to decide between their testimonies. Syphilis is a disease where opinions seem to differ. Those who favored animal virus asserted that the vaccine vesicle on a child with congenital syphilis might be quite perfect, and consequently safety could only be assured by the use of animal virus. The advocate of humanized lymph was equally certain that any competent operator could readily detect irregularities in the vesicle if the child be syphilitic, and therefore there was no real danger if you employed a regular practitioner. I quote Dr. Pratt as saying in effect that it is impossible to produce a genuine vaccine vesicle on a syphilitic person, though had I chosen I could have utilized Warlamont's statement: "A vaccine vesicle highly syphilized might represent an appearance perfectly irreproachable." So the question comes up: "Who shall decide when doctors disagree?" In this case the decision presents few difficulties. Warlamont was a merchant as well as a doctor, a vendor of calf lymph, and the remark I have quoted was made by him in an address to the British Medical Association in 1879 in advocacy of calf lymph, especially of his particular brand. Calf virus was more severe in its action, at the time he wrote; more dangerous to life than the humanized virus, and its sale depended upon the belief in its perfect safety so far as the transmission of disease other than vaccinia was concerned, and that humanized virus was not and could not be made safe. Consequently when the advocates claimed that there was no danger, that any competent vaccinator could readily tell a syphilized vesicle and avoid it, Dr. Warlamont, with entire sincerity no doubt, dissented. But the end is not here. It was claimed that calf virus might impart charbon, an inoculable disease. "No," says Warlamont, "this cannot be done," for "sick cattle will not develop typical vaccine vesicles."

It is possible, of course, that a child with syphilis can yield a

perfect vaccine vesicle, and that a cow with charbon will necessarily fail to do so, but it is highly improbable. It is true also, that Seaton states: "There are many diseases which do not interfere at all with the course of vaccination. Cline's famous first vaccination was in a lad who had disease of the hip joint. It is well known that scrofula and syphilis do not prevent the system receiving the vaccine influence in the normal way." "In this connection Seaton quotes Willan as saying: "The effect of cutaneous eruptions on the vaccine vesicle is frequent, not universal." It is not my contention that all morbid bodily conditions affect the vaccine disease to a distinguishable extent, although I believe they do except when strictly local in character; but I claim that the facts adduced show that confluence in smallpox and the high fatality that goes with that form of the disease is mainly due to some bodily condition which when present in a vaccinated person, affects unfavorably the course of the vaccine disease, and presumably, also, the features of the resulting scar. Mr. Seaton's reference to Cline's case is weak. This was the first vaccination performed in London. Neither the operator nor any of the physicians who watched the case had ever seen a vaccine vesicle before. The genuine disease as now known had never been described. Cline believed his result to be correct, but unless he had greater knowledge than Jenner possessed at the time, his opinion was worthless. He merely got a sore and through a not discreditable ignorance believed it a success because the boy afterwards resisted inoculation. Cline's description of the disease shows that it was not genuine as we now understand the term. It terminated in an ulcer. Seaton's claim that scrofula and syphilis do not affect the vaccine disease, I think, has been generally abandoned.

Inflammation as a Guide to Prognosis.

It has been shown with sufficient clearness that the course of the vaccine inflammation depends chiefly upon the bodily condition of the patient. I now intend to show that this fact has a very marked prognostic value as regards the course of other inflammations. First then: "What is inflammation?" Burdon San-

derson's definition is good, though brief. "The response of living tissue to injury." A more explicit writer says: "We may define inflammation as the sum of the phenomena which take place in the tissues as the effect of an injury." But a fuller description from another authority will make the process clearer. "Inflammation when viewed in the broadest possible light may be defined as *the method by which an organism attempts to render inert noxious elements introduced from without or arising within it.*" This doctrine is centuries old. As far back as Sydenham it was held that "an apostheme is the instrument of nature whereby she expels whatever injures the fleshy parts." The nature of the injury is of no moment unless it is of such a serious character as to inhibit response on the part of the organism, in which case prompt death is inevitable. The noxious element may be a bullet, a piece of glass or bone, a colony of bacteria or any other agent capable of producing an injury of the required extent. But however excited, inflammation is always essentially the same process. It is a natural function, as conservative in character as respiration or digestion. As air is necessary to breathing and food to digestion, so an injury to a tissue is a necessary antecedent to inflammation. But its purpose is the preservation of the organism. Like all other conservative processes, it is performed with varying degrees of efficiency in different individuals, in different races or nationalities, and in the same individual at different times. These variations in the efficiency of the inflammatory process are necessarily associated with concomitant variations in its course, its microscopical and its naked eye appearances.

If, as I have stated, inflammation no matter how excited is always essentially the same process and is also a revealer of bodily conditions, then it must follow that we should be able to tell by observation of a minor existing inflammation, no matter how induced, how the organism under observation will while it remains in essentially the same condition respond to any other inflammation exciting injury. Smallpox is the result of an injury or rather a number of injuries, and we might rationally expect to predict

with good success how the disease will terminate, if we know how the organism has recently responded to a slight wound. This method of prediction was known even to the old women who inoculated for smallpox nearly two centuries ago in Turkey. Angelo Gatti, an eminent French inoculator said of their practice: "All that is considered is whether the breath is sweet, the skin soft, and whether a little wound in it heals easily. Whenever these conditions are found they inoculate without the least apprehension of danger." So also, English observers had found that the course of the natural disease could be foretold in the same manner.

Fuller observes of smallpox: "Such whose flesh upon a cut or sore is apt to rankle much are apt to have it worse than those whose flesh useth to heal easily." John Hunter evidently held the same opinion, for he writes, "If the constitution is such at the time as would readily fall into an unhealthy inflammation from common irritation or accidental violence then it will also fall into that state when irritated by a specific irritation foreign to the constitution, such as smallpox which in this case will run into the confluent kind."²⁰

With the advent of vaccination all knowledge of a relationship between wound and variolous inflammation seems to have been conveniently forgotten; but the fact that the course of an inflammation depends upon the state of the patient's health is as fully recognized as before.

Niemeyer, discussing the differing tendencies of the feeble, ill-nourished subjects and those who are well-nourished and strong, states of the former: "It is said of such persons that their 'flesh does not heal,' that is, that a trifling wound is apt to be followed by severe irritation and copious suppuration of the wounded part."²¹ Beale asserts that even in so ephemeral a disease as sick-headache. "It has been noticed that any wound or scratch that there may be on the surface of the skin looks angry. The processes of healing and the nourishment of tissues do not proceed as in perfect health."²²

The "Genuine Disease" is Described by Prognostic Features.

In the "genuine vaccine disease" there are five indispensable characteristics. All the vaccinators know or claim about the matter, is that when a person whose vaccinia exhibited these characteristics, has smallpox not very long after the vaccine operation he is likely to have the variolous disease mildly; but if these features were absent then the patient is likely to have the variola more severely. These features are: 1st. As to the course of the disease, it should be regular; 2nd. As to the vesicle, it should be (a) pearl-colored, (b) plump and distended; 3rd. As to the areola, it should be (a) distinctly circular, (b) crimson colored. I purpose to take up for consideration these several traits, and to show that by them is secured a quintuple sortation, and to make it obvious why "every smallpox in proportion to its mildness, approaches cow-pox in its progress and appearance."

The Course of the Disease.

"Having watched the vaccination through its course is the best test we have of the security of the system against smallpox."

The course of a disease is known by the succession of symptoms manifested during its continuance. In diseases usually terminating in recovery, the benign and most frequent form is necessarily considered the regular and typical form. Its occurrence shows that nature works well and furnishes a valid ground for a belief that in any similar disease nature will again work well.

Dr. Rauch thus recognizes the connection between the regular course in vaccinia and good health: "In normal, uncomplicated vaccinia following the introduction of good humanized lymph or crust *there is a uniform succession of symptoms which proceed with almost unvarying regularity in healthy subjects.*"²³

Dr. Ellis discerns this principle of regularity in all acute diseases "originating in the healthy organism." They run their "respectable and time-honored course" whether "rheumatism, pneumonia or whatnot" and "will under ordinarily probable circum-

stances resolve and get well." "These are the cases that vaunters of specifics exult over."⁴

But if it be true of the acute diseases in general that where a disease runs the typical course it will ordinarily terminate in recovery and that the regularity indicates a healthy organism, typical vaccinia must mean good health and probable recovery in the event of smallpox occurring not long after the application of the test. And the closer the relationship of the disease in question the more reliable will be the sortation. Even if it were demonstrably true that vaccinia is a form of smallpox it would not in any way affect the claim that there is a great amount of sortation present and that the actual amount should be determined with all possible accuracy. No one claims that the immunity conferred by smallpox, scarlet fever or measles is in any way dependent upon the course of the disease.

The Vesicle.

Its color. The color of vesicles and pustules depends upon their contents, modified somewhat by the thickness and other qualities of the skin through which the pus or lymph is seen. In the "genuine disease" the vesicle is pearl-colored. In the mild or genuine smallpox the pustules are of a yellowish tint ranging from a nearly white to a straw color. This difference in color is due to the differing proportions of pus and lymph in the pocks. The variolous pock is a typical pustule and when its contents are thick and yellow and free from blood the pus is known as laudable or healthy. The vaccine pock is not a typical vesicle but a vesicopustule. In the mild or genuine vaccinia the lymph in the vesicle predominates and gives the vesicle the characteristic color. In persons of the pyogenic or pus-forming habit the vaccine eruption is pustular and non-genuine. The contents of vesicles and pustules are the ordinary products of inflammation and the imprisoned bacteria or other specific elements.

The products of inflammation vary according to the health of the individual. Heintzman found on examining the contents of

variolous pustules, that "in persons of a good, strong constitution," "the pus-corpuscles look coarsely granular, viz: are supplied with a large amount of living matter on the points of the intersection of the living reticulum," while "in persons of a weak, so-called scrofulous or tuberculous constitution or in persons debilitated by different acute or chronic diseases," the pus "was finely granular, that is, scantily provided with living matter." "In the former instances the pus is thick and yellow; in the latter instance watery, serous and pale." No similar inquiries have been prosecuted in regard to vaccine lymph, but Paget's observations on lymph procured by blistering are of the same tenor. In persons with the highest health the fibrin was clear and uniform. As patients deviated from the highest health the fibrin became more paste-like, turbid, nebulous, dotted and mingled with minute oil molecules.²⁵ After some practice one might form a fair opinion of the degree in which a patient was cachectic, and of the degree in which an inflammation in him would tend to the adhesive or to the suppurative character by the exudations.²⁶ Clearly there is a laudable lymph as well as a laudable pus; the latter gives the yellow or straw color to the variolous pustule indicating that nature works well, and the former gives the pearlish tint to the vaccine vesicle and has the same significance. We can safely go further and say that after much study of the vaccine disease and of subsequent variolous manifestations, observers can form a fair opinion of the degree in which a variolous inflammation will tend to the confluent or to the distinct variety for a limited time, by a naked-eye inspection of the color of a vaccine inflammation.

Its form. In the "genuine vaccine disease" the vesicle is plump and distended. In smallpox a well-filled pustule is a hopeful sign. "When they stand erect and are of a rosy hue about the base it is a sure sign that nature works well." Gregory, after explaining that "confluence is always unfavorable," adds, "nevertheless, if the pustules acuminate well, and exhibit a crimson areola a good ground of hope exists"²⁷ Whence the prognostic value of plumpness? It shows an abundant exudation and there

is an "unquestionable antagonism between inflammatory reaction—that is abundant exudation and emigration—and the manifestation of infected virulence." The danger in smallpox is largely due to the absorption of the contents of the pustules. This is the cause of the secondary fever so characteristic of the confluent form of the disease. Where there is "abundant exudation and emigration" this "manifestation of infective virulence" is prevented.²⁸

A plump vaccine vesicle is therefore a rational indication that the bearer is but little liable to the secondary fever of smallpox.

The Areola.

"The areola is a circumscribed redness of the skin, perfectly circular in form and five or six times the diameter of the pock itself. It is sharply defined and of a vivid red hue."²⁹

"The establishment of the areola demands attention as the evidence that the specific effects of vaccinia have been produced."³⁰

Very rarely do writers attempt to give the diameter of the areola; it varies considerably within recognized limits and we may properly ignore the question of size; form, color and sharpness of outline are the features of interest.

Its form. This, in the genuine disease is identical with that of the most favorable type of smallpox. "The best smallpox, viz: the benign rise into a globular shape and form perfect circles at their base. The bases of the contiguous are not perfect circles but the nearer the general run of them approach to true circle we form the more favorable prognosis of the disease." As this passage might be construed to mean that the pustules rather than the areolae were perfectly circular, I give another citation to cover this point. "In the most benign smallpox from their first appearance the pustures are surrounded with a perfectly circular inflamed margin. When the pustules are more numerous though still of a favorable kind the margin is less exactly circular."

Its color. In the definition quoted the color is called "a vivid red hue." More commonly it is described as a damask or crimson

rose color. Jenner's simile, "the pearl upon the rose," refers to this hue. As with the circular form so also the specified color is a sign of benignity in smallpox. Sydenham states: "The inflammation of the face and hands being in the meantime come to its height renders the spaces between the eruptions of a florid red color resembling that of damask roses, and the milder the smallpox is the nearer do the eruptions and their intermediate spaces approach this color."³¹ Authors dealing with inflammation in general usually comment on the significance of the florid hue of the skin. One writes: "The shades of the red vary but the more they deviate from the arterial the more unfavorable is the type of inflammation."³²

Vaccinia Described With Unique Facility.

"Although you may read numerous valuable treatises on smallpox, it will be difficult to form in your own minds an harmonious picture of the affection due to the considerable variations in the symptomatology. This is due rather to the disease than to writers on the subject."

As vaccinia is alleged to be simply smallpox shorn of its contagious quality but affecting the human organism in the same way as true smallpox though less profoundly we should expect equally wide variations in its manifestations, but according to vaccine writers just the reverse occurs.

Adams, a contemporary of Jenner, though wholly unaware of the cause of the unique feature, thus testifies to its presence: "The disease is, however, so uniform in its appearance and so regular in its progress as to be described with more certainty and consequently liable to fewer errors than any other with which we are acquainted."³³

Genuine vaccinia or simply vaccinia as used by Adams is a juggling term. It refers not to a disease as it appears in vitally different classes of people but as it appears in persons who react to the vaccine irritant in a particular manner. Any disease could

be described with equal facility if restricted with equal rigidity to a certain type. If writers on smallpox were to apply the term genuine or successful to typical cases of the discrete form and teach that the confluent, corymbose, hemorrhagic and the other varieties had no specific relation to the genuine the difficulty noted by Kaposi would promptly disappear.

Spurious Vaccinations.

"It will constantly happen that spurious vaccination will prevent subsequent vaccination from taking effect perfectly."

This claim is not peculiar to Mr. Seaton. It is strictly orthodox, much used, and is as pitiful a piece of mal-reasoning as one can easily find. Plainly the legitimate presumption is that the second spurious result is due to the continued presence of the conditions that made the first vaccination spurious, and until the vaccinator can show what those conditions were, and that they were absent on the second and later trials the assumed effect of the first vaccination on the second is illogical. As contributions to pathology Mr. Seaton's opinions are interesting. Endorsing and explaining Jenner's views he says: "The system of a person who had been vaccinated was regarded by him as having already passed through smallpox, and as being *quoad* future smallpox exactly in the condition of a person who had smallpox in the ordinary way."

Taking the two statements together they amount to this. Genuine vaccinia protects from smallpox because it affects the constitution in the same way as smallpox. Spurious vaccination is a prophylactic also. It does not prevent a like disease but begets it. It protects from an unlike disease, genuine vaccinia, yet is no protection from a disease, smallpox, which in its essential nature and in its effect on the constitution, is the same as genuine vaccinia. This is a palpable shuffle but we may accept the statement of Seaton and others that spurious vaccinia is a matter largely beyond their control and is apt to be so permanently.

Graded Protection.

Smallpox, scarlet fever and measles have been known and studied for centuries. A first attack of one of these diseases commonly protects from a second. The recurrent attacks, though very infrequent in comparison with the primary attacks, have still been in the aggregate sufficiently numerous to afford large opportunities for observation. They have been studied and speculated upon by many minds for hundreds of years; yet we are not able in the slightest degree to divide these protected persons into well, indifferently and poorly protected. In none of the undoubted forms of protection are we able to detect such a thing as grades. Health, vitality, healing power, inflammatory reaction, are all things of infinite gradation in nature and are susceptible of grading in practice.

No two persons will have a given disease alike. A smallpox patient may have only one pustule or he may have six thousand; he may not have any pustules at all or he may be covered so completely in every part of his body that you cannot place a pin's point between the pustules. Every other manifestation of the disease exhibits an equally wide range of differences, but the amount of protection conferred so far as our knowledge goes is always the same. It is true that recurrent attacks sometimes occur in all these protective diseases and it is possible that the recurrence may be due to some peculiarity in the primary attack, but we have no trace of information on this point. If graded vaccine protection or mitigation actually exists it is a strictly unique phenomenon and is likely to remain so.

English and American Immigrants.

Mr. Marson, as the result of his experience in the London Smallpox Hospital, concluded that the quality of vaccination in the different nationalities was as follows: 1. *Danes, Swedes, Norwegians, Germans.* 2. *Italians and Spaniards.* 3. *Scotch.* 4. *Irish.* 5. *English and French.* According to a paper based on the 9th

United States census returns, the general death-rates of the different elements of our population to each 1,000 of their numbers were: *Swedes, Norwegians and Danes* 9.2, *Germans* 11, *English and Welsh* 11.4, *Scotch* 12.5, *Native White* 12.7, *Native Colored*, 13.9, *French* 14, *Irish* 14.6.³⁴

The italicised classes are the only ones given in both groups that we can infer to be constituted alike in both countries, and their similarity of arrangement is very noticeable. The Scotch when compared with the Irish have the advantage in both lists. The Irish are at the foot in one list and the French in the other, but their death-rates, American experience are so nearly alike that the transportation is of no moment. Leaving out the Irish whose London and American representatives are not probably quite similar the French are the last in each case. Altogether the two lists support strongly the view, that good vaccination, a low variolous fatality and a low general death-rate are all due to one common cause, good health or vitality.

Anglo-Indian Children.

“Mr. Marson, of the Smallpox Hospital in London, while I was on a visit to that institution some three years ago, remarked to me, ‘Vaccination in India is the most worthless I have ever seen; most of the children who come from India are not protected by their vaccination.’”³⁵ This being true, the Anglo-Indian children ought to have been, from a sortation point of view, an extremely unhealthy class. The implication is here that the operators were at fault. No reason is assigned for this great want of skill in the medical attendants of the English in India. They are usually English doctors and surely ought to be able to perform vaccination properly, and if their results were exceptionally poor we should look to the condition of the children for an explanation. Mr. Marson did not do this. I have examined several treatises written by medical men of India, and there is a complete agreement with the substance of this statement. “Uninterrupted residence of European children in a tropical climate, from birth upwards, is

inimical to health and antagonistic to the development of a sound, robust constitution. The child commonly grows up delicate, pale and flabby, comparatively feeble in mind and body; often timid and unstable, and but seldom able to compete on equal terms, either physically or mentally, with those children brought up in England, or even with the educated natives." Let me add, the death-rate of these children at the time when Marson spoke, was more than double that of English children reared at home. If born robust and they maintained even a fair condition of health, considerations of expense, and that natural desire of parents to have their children with them, kept the children in India. If born feeble or if they deteriorated early they were sent to England to recuperate. The latter is the class Mr. Marson was accustomed to see in London. These children would succumb easily to any epidemic disease. In measles, scarlet-fever or diphtheria their heavy fatality would be ascribed to the deteriorated condition; but in smallpox the wish being father to the thought it would be ascribed to the imperfect vaccination. These children were unable to compete physically, which includes vaccinally, with English born children or with the native born East Indian. Since Mr. Marson's observations were made great progress has been effected in the healthful rearing of Anglo-Indian children. Their death-rate has fallen greatly and it is probable that there has been a corresponding improvement in vaccinal skill of English doctors in India.

Effect of Marson's Teachings.

Mr. Marson found as he thought that patients with multiple scars showed more recoveries than patients with but one scar. That was correct. He also found that patients having good or foveated scars showed more recoveries than patients with poor scars. This also was correct. He inferred and sought to prove by his statistics that these facts stood in the relation of cause and effect and that the vaccinators if they wished to could produce four or more good scars in all cases and reduce the fatality of the vaccinated to a fraction of one per cent. His inference was wrong.

His statistics were disingenious but his views were widely accepted. The British government sought to have them put into practice and was largely successful. The vaccinators expected, as they had a right to do from their premises, that the marvelous low fatality of the four scar class would continue and that the aggregate fatality of course would be proportionately lowered. Just the reverse occurred. The average fatality increased because the per cent. vaccinated increased. The fatality of the four scar class increased because it was becoming less select. The fatality of the four scar class in the London Hospital in 1836-51 was 11.1 per cent. In the same hospital 1852-67 it had risen to 19.5 per cent. In Fulham Hospital 1877-79 it was 30.8 and in the same hospital 1880-85 it was 42.3 per cent. The explanation offered for these increased fatalities was that the virus had degenerated. Resort was had to the cow but without improvement. The puzzle remains. If all of the patients had four or more vaccine scars the fatality would be the same as if they all had one scar. The Germans all have many scars and their vaccinal fatality is very high.

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CHAPTER IX.

Good and Poor Scars.

A good scar is one of a type that has been empirically ascertained to be associated with the milder forms of smallpox with a frequency too great for chance. The vaccinators teach that it is the result of skill on the part of the operator, and of care in the selection of the virus. There is some truth in these claims, but there is no evidence to show that the poor scars that might have been prevented by care or skill bear any relationship to severe variola. For good scars there must be good soil; but poor scars may be due to poor soil, to an excessively irritant or otherwise abnormal virus or to mechanical interference with the course of the inflammation. The last two causes can be to a great extent avoided by care on the part of the vaccinator and of the patient's care-takers. The first mentioned cause is removable in a number of cases but it is rarely if ever attempted. Taking vaccinees as a whole the bodily condition dominates the character of the scar. To secure a good scar it is essential that the antecedent inflammation is non-specific. This is plainly indicated by the fact that scars indistinguishable from those of unquestioned vaccination by any present-day skill have been produced by the use of a variety of non-specific irritants. Councilman states:¹ "The writer knows of a college fraternity in which it was the custom to brand neophytes on the arm with a cigar. The resulting cicatrices have often been exhibited to health officers and accepted as evidence of especially thorough vaccination. The cicatrix resulting from burns by strong mineral acids gives the so-called typical or foveated scar. In certain sections of the country in the last epidemic, it was not uncommon among the anti-vaccinationists to have nitric acid applied and to submit the resulting scar as evidence of vaccination." Dr. J. Snyder writes: "I have known a well-pitted scar that is regarded in the adult as characteristic of a 'good take' to be due to a burn from a live coal. A negress in this city who was

very averse to submitting to vaccination produced such a scar by a self-inflicted burn. For a number of years she successfully deceived inspectors."² When at last the negress undeceived her dupes her word had to be fortified by the testimony of her mistress, a lady of high standing, before it would be taken.

A New York physician who had vaccinated 100,000 patients and had officially inspected the arms of twice that number, reported that he passed a scar resulting from a dog bite as a good vaccine scar.³ When a particular result can be obtained by the use of agents as diverse in character as matter from a sore on a child's arm, or on the shaved abdomen of a calf, the burn from a live coal, a cigar or a mineral acid or by a dog bite, it is a sound presumption that it is not the agent but the thing acted on that determines the result. He who denies that sinks the scientist in the partisan.

Characteristics of the Good Scar.

Foveation. "A well-foveated cicatrix is, next to having watched the vaccination through its course, the best test we have of the security of the system against the smallpox."⁴

By foveation is meant the presence of minute indentations or dots in the scar. Their relation to a sound vitality has never been pointed out, but there are some pertinent facts that may guide us aright in the field of conjecture. It appears that the vaccine vesicle is multilocular and it is commonly held that the number of foveations corresponds to the number of cells in a vesicle. The indentative impress is certainly the result not of an instantaneous but of a gradual process, connected with cellular evolution. In the later history of a vesicle the cell walls break down and the cells become confluent. When this occurs it is quite certain that the foveating process, if the number of foveations correspond to the number of cells, will be arrested and it is equally certain that the thinning and rupturing of the septa will be affected by bodily conditions and occur with varying degrees of promptness in dif-

ferent persons. It is reasonable therefore to suppose that in persons having a tendency to confluence in eruptions the cell walls would break down at an earlier stage of cellular development than in those of a discrete tendency, and in this way lessen the distinctness of, or entirely prevent foveation accordingly as the confluent tendency is more or less marked. This supposition finds support in the observations of Ceely. "When the regular vesicle is neither ruptured nor spontaneously bursts the crust is often retained to the end of the fourth or fifth week, bringing away some of the subjacent cellular tissue, leaving a deep foveated red cicatrix or a yellow, foul, excavation which ultimately furnishes the pink, shining, puckered scar. But it too often happens, especially in subjects with thin and vascular skin that the vesicles burst or are easily broken during the height or about the decline of the areola; and if the subject be of the strumous or erysipelalous diathesis, of full habit, and possesses an irritable skin, secondary inflammation is set up and becomes more diffused and deeper seated, the corium is destroyed completely—all this mischief soon subsides—and an unexpectedly small circular or oval, red, shining, puckered, elevated and uneven cicatrix succeeds."

We could hardly expect a vaccinator like Ceely to recognize more clearly the dependence of the foveated or good scar and of the shining, puckered, elevated and uneven or bad scar upon the individual constitution. Foveation is here stated to be prevented by rupturing and by the spontaneous bursting of the vesicle. This spontaneous bursting is due to thin and vascular skins very commonly associated with the erysipelalous diathesis. But in some instances we have, following Ceely, an absence of foveation and a bad scar, the pink, shining, puckered scar without a rupturing or spontaneous bursting of the vesicle. We may, however, pretty safely infer that where there is spontaneous bursting of the vesicle it is always preceded by a thinning and rupturing of the cell walls until the vesicle becomes unilocular. That is, we may have a complete disintegration of the trabeculae with arrest of foveation without external rupture.

The belief that the non-foveated scar made so by the forcible rupturing of the vesicle has the same meaning as regards smallpox as the non-foveated scar, the result of diathesis or of dermic peculiarities, is one of the many whimsicalities of the vaccine contention. Does scratching make smallpox spurious and unprotective? It affects the character of the scar.

But there is another way in which foveation contributes to sortation. Some good observers say, "It is probable enough that a longer period is required for the complete obliteration of a vaccination cicatrix than for the mere loss of foveation."⁵ The absence of foveation, therefore, would mean in many instances that the vaccine test for bodily condition was made many years before, and, of course, had lessened value. Persons whose scars were so old that the foveations had disappeared would probably be in an age class with high fatality.

Depression. Seaton describes the scar of the genuine disease as "circular, somewhat depressed, foveated or indented with minute dots and sometimes radiated."

Next to foveation, depression or cupping is the chief characteristic of the good scar and if the sortation theory be correct there is a causal relation between the depressed vaccine scar and a sound vitality. The scars are formed from the fibrin, plastic or living matter, thrown out at the seat of inflammation.

Heintzman, studying variola, found this living matter more abundant in healthy than in sickly persons. Paget's earlier-made researches support this view. He blistered thirty hospital patients and examined the exudations, microscopically, finding that the highest health is marked by an exudation containing the most perfect and unmixed fibrin; tough, elastic, clear, uniform and of a filamentous appearance or filamentous structure. As the patients deviated from this highest health the fibrin became "less and less filamentous, softer, more paste-like, turbid, nebulous, dotted and mingled with minute oil molecules."⁶ The fibrin forms the scar and its gradual contraction, I infer, causes the cupping, and if the toughness, elasticity and filamentous structure of the

fibrin are proportioned to the health and vitality of the patient it is certain that the sharpness of the depression is due more to the condition of the patient than to the skill of the operator.

A number of other explanations of pitting have been offered but none of them are quite satisfactory. Sydenham traced the pitting in smallpox to the falling off of branny scales, which he considered to be of a more corrosive nature in the confluent form of the disease than in the discrete. Walker concludes that the pits are due to "*the pressure of these condensated pustules upon the tender cutis* producing the same effect as that of a seal impressing melted wax."⁷

Another old view was that the pitting was due to "the expulsion of a small slough." The latter is perhaps the view most generally held at present but there is strong individual dissent. Bakewell asserts: "There is no slough forms in the ordinary course of the eruption; but the pitted scar of smallpox is as different as possible from the smooth scar left after a sloughing surface has healed: the pitting is caused by the pressure of the scab remaining on too long."⁸

From the position taken here, i. e. that the pitting is due to the gradual contraction of the scar and that it will be most marked in healthy persons, the class that have discrete smallpox, it follows contrary to common belief, that the pits in discrete cases will be deeper in proportion to their size than in confluent cases.

The Good Inoculation Scar.

If the vaccine scar is an index to the bodily condition then all other scars must be so; though as our knowledge is empirical we may be wholly unable to classify them. Some study, however, has been given to the scar of inoculated smallpox. In the third decade of last century when scars of this kind were quite common, Professor Miller advanced the theory that the good inoculation scar had sulci or little grooves in place of the foveations in the vaccine scar. Some years later, in 1838, Dr. Bigsby prosecuted an exhaustive inquiry into the protection of the inhabitants of

one ward in Newark, England.⁹ There were of the inoculated 1,100 persons: With perfect marks, 893; with imperfect marks, 179; without marks, 36. There were of the vaccinated 1,097: With perfect marks, 878; with imperfect marks, 186; without marks, 33. In both classes there were about 16 per cent. with imperfect marks and about 3 per cent. without marks. Dr. Bigsby does not give the basis of his classification in either body but the fact that the proportion of good and bad scars were the same in both groups is significant. We may infer that the two classes of operators had about the same defects in skill or in virus or that they were confronted with the same limitations as regards bodily condition. Each reader must decide for himself. As regards the vaccine scar Dr. Loundes had a somewhat confirmatory experience. "The most absolute failure," he states, "will occur in systems that have never been touched by vaccine. I have allowed about 19 per cent. for those which show evidence of the vaccine sore after the first week. These are mostly called perfect-taking in statistical tables."¹⁰ From his account it is apparent that Dr. Loundes was a very successful operator and cases that did not take at all were very rare with him. This would increase his percentage of bad results, as this class of cases are apt to fail altogether in unskillful hands, by about the percentage of absolute failures in the Newark cases, 3 per cent.

The Excess of Poor Scars in the One-Scar Class.

If the quality of the vaccine scars were practically a matter of the operator's intent and no sortation, conscious or unconscious, were present we should expect to find about the same proportion of good, bad and indifferent scars among those who had but one scar as among those who had two or more scars. No one, as far as I know, has ever claimed that the operators who prefer one scar are less competent than those who prefer two or more scars. Dr. Welsh believes that one scar is as protective as any larger number, and he traces the high fatality that marked the one-scar class in his experience "to the fact that a very much larger pro-

portion of the patients under this head than under any other showed "poor" marks. Doubtless the Doctor was right, but he should have told us why the one-scar class has this excess of poor scars.

That the reader may see the extent of this vaccinal peculiarity a percentage table is here given showing Dr. Welch's experience, covering a period of twenty years and embracing 5,000 cases.¹¹

TABLE XXII.

		Good	Fair	Poor
1	Mark-----	38	21	41
2	"-----	57	23	20
3	"-----	56	21	23
4	"-----	58	19	23

Looking at the table we see that there is in three of the classes that uniformity of result that we should naturally anticipate, the variation in no case exceeding 4 per cent. But the class with one scar differs from the other classes from 18 to 21 per cent. In Dr. Welch's experience the proportion of "poor" marks to "good" is nearly twice as large in the one-scar class as in either of the others. This is a very interesting fact but Dr. Welch dismisses it with only the notice quoted. In treating of the methods of sortation I stated that operators who usually produced two or more scars would in case of delicate or sickly children from prudential considerations produce but one scar, and that this on account of the ill-health of the child would be in most cases a poor scar. I also stated that operators who intended to produce two or more scars frequently failed in their purpose because the pustules ran together as a result of the confluent diathesis, the resulting scar being generally "poor." Thus there are two distinct causes for this excess of poor scars in the one-scar class. Indeed if this peculiarity did not exist its absence would be a strong argument against the sortation theory.

The Superiority of Poor Scars of German Origin.

There are two general causes of poor scars, diathesis and traumatism. From the vaccinator's standpoint, a high fatality goes

with poor scars, no matter how produced. The more imperfect the vaccine scar the less the protection or mitigation and it is immaterial how the imperfection arises. The sortation theory holds that a high fatality goes with poor scars of a diathetic origin exclusively, except where a scar has become faded on account of age, and its sortative value has lapsed and that poor scars resulting from scratching, rubbing or puncturing have no relation to fatality. If now, we can find a class of persons where traumatism is allowed to interfere with the course of the vaccine disease and with the resulting scars to an unusual extent, this class ought to exhibit lower fatality from smallpox in connection with poor scars than we should otherwise expect to find. The Germans are such a class.

Of these as observed in New York Dr. Loundes says: "It is well known that the German practice has been to make so many large sores that considerable irritative fever or hectic(?) would ensue. The German plan causes unnecessary suffering and often too deep suppuration for a good vaccination."

Here we have the testimony of an expert with large experience, that the Germans have a vaccinal method that interferes with the production of the good scar. Dr. Conrad's observations are confirmatory and he distinctly notes the marked absence of foveation in German patients.¹² Consequently we might expect that poor scars in Germans would have a better reputation than those of other nationalities. Dr. Welch remarks of his experience in the Municipal Hospital: "The difference between the rates of mortality among the cases showing 'good' marks, as is seen under the three nationalities mentioned, is not great and the slight difference that does exist may be entirely accidental. But the difference between the death-rates of those showing 'poor' marks is very great and decidedly in favor of the patients of German birth. The vaccinations performed in Germany prove to be more uniformly protective and hence the death-rate among the post-vaccinal cases under this head is the lowest of any of the nationalities."

Referring in another place to the low fatality of patients in general with four or more "poor" marks, he adds: "It is indeed almost as low as those showing four or more 'good' marks. The explanation of the low death-rate here is that nearly all the patients classified under this head were natives of Germany, where, as already shown, vaccination was so efficiently performed that if the scars are not in every respect typical there is nevertheless well-marked protection."

Doctor Welch was puzzled but his curiosity was satisfied by an original explanation of oracular no meaning. It is proper to add that Dr. Conrad states of the patients in his charge that the Germans had smallpox with the greatest severity, and he traces this fact to their unfoveated cicatrices, but he gives no statistics. That the Germans had an exceptionally high smallpox mortality in this country for a score of years or more is true, but their fatality was usually if not uniformly low. So far as we can learn these peculiarities are still present. Dr. Conrad seems to have recognized the first feature and Dr. Welch the second feature exclusively.

Misleading Classifications.

While we may properly recognize that there are certain types of vaccine scars technically termed good and poor, and that these, when of recent origin, are commonly associated with mildness or with severity in attacks of smallpox, it is also well to realize that in deciding whether a scar shall be classed as good or poor much depends upon the educational bias of the observer and the strength of his desire to make the facts fit the theory. The varying results obtained by different observers are well shown by Dr. Tebb.¹³

"It is worthy of notice that in classifying cases of smallpox according to vaccination marks different methods are adopted by different observers. Thus Dr. Gayton informed the Royal Commission (2, 1700-06) that when he found one good mark and three

imperfect ones, he might class them as a case of two good marks, or he would ignore the three imperfect marks, and class the case as one of a single good mark. Of 10,403 cases of smallpox admitted to the hospitals of the Metropolitan Asylums Board during 1870-84 Dr. Grayton classified 2,085, or 20 per cent., as vaccinated with good marks; whereas, at another hospital of the same Board, during the years 1880-85, Dr. Sweeting placed only 39 out of 2,584, or 1.5 per cent., in the category of good vaccinations. The Dissentient Commissioners, Dr. Collins and Mr. Picton, observe (Section 129): "It is evident that such a difference indicates a wide margin for personal discrimination as to what is and what is not good vaccination. It is, therefore, not altogether surprising to learn, on the authority of Dr. M. D. Makuna, when medical superintendent of the Fulham Smallpox Hospital, that what one will call an indifferent mark, another will call fair, a third moderate, and a fourth bad, and so on, till the confusion is worse confounded."

But, while in England they have grave difficulty in drawing the line between good and poor scars, they have no difficulty, contrary to American experience, in distinguishing the true vaccine scar and those of other origin. The following extract from Dr. Sweeting's testimony before the Royal Commission lacks nothing in positiveness and apparently he did not intend to imply that his knowledge was exclusive.

"3818. (Mr. Savory): Is there any difficulty in recognizing a genuine vaccine scar? Not in the least.

"3819. It is a distinct mark? Yes; sometimes we have patients with burns, but they are perfectly different marks.

"3820. Suppose there was a scar in the situation of the vaccination scar, should you be deceived? No.

"3821. There is a typical character about the vaccination mark which shows that the person has been vaccinated? Yes." 14

Some later writers do not concur in Dr. Sweeting's opinion,

for we are told that foveation "would seem to be an indication of the depth of the cicatrical tissue. Whereas as severe burns do not leave foveated scars a superficial burn will leave a scar showing a pitted surface which is identical in appearance with the surface of a well foveated vaccination scar." We are also told that "foveation is not essential" and that it "is not negligible." This means that the cicatricial test for bodily conditions must be applied according to fixed rules. There must be a standardized wound and a standardized virus or other irritant; otherwise the failure to secure foveation is without significance. It is evident that the friends and the foes of vaccination are getting together. The former are recording the phenomena and the latter are doing the interpreting.

Increase of Poor Scars in England.

In a table prepared by Dr. Charles Cameron, M. P.,¹⁵ we find that the percentage of persons in the London hospitals having good scars was progressively on the decrease for a term of years. Thus Marson gives for the period 1836-51, 63.33 per cent.; for the period 1852-67, 44.4 per cent. In Homerton Hospital from 1871-78 there were 37.96 per cent., and in Hampstead and Deptford 1876-79, 36.25 per cent.

The explanation from a sortation standpoint can be briefly given. Good scars are the result of the genuine disease. The unvaccinated have at all times, in communities where many persons have been vaccinated, an undue proportion of those who if vaccinated would have poor scars. It is the exclusion of these that brings about the large percentage of good scars and the associated low fatality of the vaccinated. Throughout most of the period covered by the statistics the British Government sought by measures of increasing compulsion to extend the practice of vaccination. It succeeded well but the recruits were largely from classes that give bad results. Governments can decree, doctors can vaccinate, but nature makes the scar and fashions each indi-

vidual's, when not interfered with, according to his physiological merits. I have shown that the fatality of the vaccinated increases as the class increases in numbers because of the necessity of including a steadily increasing proportion of unfits. This carries with it by implication that there would be an increasing proportion of poor scars.

Dr. Cameron, however, had a different explanation. He attributed the change wholly to an unconscious raising of the standard of good scars. If that were the case the fatality of those with good scars ought to be lessened. But the result did not follow. On the contrary, there was an increase, and in his own words, "this increase is most remarkable in the most amply vaccinated cases—the cases with three or four good cicatrices—where in 1877-79 the mortality is more than thrice what it was in 1852-67." Dr. Cameron believed in animal virus and the article from which the extracts are taken was written to show that humanized virus had degenerated and lost much of its protective power. What it did show is that poor scars increase as sortation decreases.

Changes in the Character of the Good Scar.

For a full century we have been taught that the good scar was "excavated or depressed" and that this type of scar went with mild smallpox. Now this claim is being abandoned. In a recent work we are told that the vaccine scar "is in the vast majority of cases contaminated by a variety of organisms, most if not all of a non-pathogenic character" and also that "deep pitting of the resulting cicatrix is probably caused by the action of some extraneous organisms."¹⁶ If it is true that the deep pitting is due to the presence of extraneous germs of a non-pathogenic character and at the same time is correlated, as has been claimed for a hundred years, with mild smallpox, we have an added fact favorable to the sortation theory, for in that case the correlation would be with simple inflammation and not with a specific inflammation.

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CHAPTER X.

Single and Multiple Vaccine Scars.

Illogical Character of the Vaccinator's Claim.

Of all the specious arguments that have been used to convince men that there is a cheap and personally unmeretricious way to avoid disease and death, few have been more potential than the tables prepared by Mr. Marson and others, showing a relationship between multiple vaccine scars and mild smallpox. We have here the near point of vaccinal proof. The operator can usually produce as many scars as he desires, and taken as lump bodies, those with four or more visible scars have smallpox much less fatally than those with but one scar. To the uninformed reader this argument almost invariably looks to be absolutely conclusive. Yet there lurks a fallacy here; not one that he who runs may read, but one that anyone with moderately good reasoning powers can be made to understand. The first of these tables published was prepared by Mr. Marson and represented his experience in the London Smallpox Hospital for 16 years, 1836 to 1851, inclusive. Its alleged teachings as regards plural marks was hailed as a great and beautiful discovery. The cause of vaccinal failure was supposed to have been laid bare and the vaccinator's future took on a rosy hue. All that was necessary was to vaccinate up to Mr. Marson's standard, "four or more good marks," and smallpox would disappear from the earth. The favor with which Mr. Marson's effort was received stimulated imitation and similar tables are now very common.

These tables prove the existence of a causal relation between multiple vaccine scars as observed in hospitals at the time of admission of the patients or shortly after, and mild smallpox. That is, they furnish for scientific research what is known in detective circles as a clue but in common with the rest of the alleged evidences of mitigation they support the sortation theory to the same extent that they support the vaccinator's contention. In

the more than sixty years that have elapsed since Marson wrote, no English doctor, as far as is known, with the exception of Mr. Ballard, whose juggling feat has already been examined, has sought to show that the admitted relationship is that of cause and effect except by persistent repetition of these irrelevant statistics.

Vaccine Pathology vs. Vaccine Statistics.

If vaccination confers immunity from smallpox, one insertion of the virus should be as effective as any larger number, provided, of course, that one insertion secures an infection of the organism. The vaccine virus is supposed to contain living germs either vegetable or animal. These low forms of life multiply with great rapidity, their numbers being limited only by the supply of food or of some other factor essential to their existence. The only possible effect of increasing their numbers would be to shorten their banquet time. Even this is not accomplished by multiple insertions of the virus. The appearance of the areola on the eighth or ninth day is alleged to be the sign of constitutional infection, the index of immunity, and this is in no way hurried by the use of more virus.

There is an irrepressible conflict between the pathological teachings of the vaccinators and their statistics, but it does not seem to disturb their faith. Those who advocate one scar only, and they are in a large majority in this country, get over the difficulty by saying you can prove anything by figures, while those who incline to multiple scars assert that while the one scar theory is all right, figures prove the contrary, and they prefer fact to theory, and the problem is solved as far as they are concerned. A number of years ago Dr. Swift brought this difficulty to the attention of a convention of Massachusetts doctors in these words: "I should be very glad to believe that one perfect vesicle would give as great an amount of protection as multiple insertions, but the statistics which I have here given seem to disprove that." ¹

"It is difficult for me to understand why multiple vesicles

give more protection than a single one. Vaccination produces a constitutional disease and I fail to see why one vesicle should not do the work." His query brought no response.

Roger N. Goodman, an English doctor, acknowledges his faith in multiple scars, but says: "It is true that at present we are unable to produce analogies from other bacteriological work which suggests a greater protection from the inoculation of greater numbers of bacteria though it may be that the influence of vaccination is due to a toxin formed by the growth of micro-organisms at the seat of inoculation and not as is often inferred in the general circulation, but with the theory we are not so directly concerned as with the facts."²

Not only is the multiple-scar theory without analogical support, but it has been found by experiment to be unfounded. Camper, a French inoculator, tested the theory by direct trial. He inoculated his patients with smallpox virus, making from one to seven insertions in different cases, and found that the number of insertions made no difference in the result. His teachings have stood for more than a century unquestioned. Dr. Goodman claims that the beneficial effect of four or more insertions of the virus is a proven fact and the claim that one insertion is as good as any larger number is a theory, and his professional brethren in England agree with him. In this country the sufficiency of one scar is regarded as the proven fact and the alleged benefits of multiple insertions of the virus as the theory. It is evident that neither the English nor the American doctors can distinguish between fact and theory in matters vaccinal. Seemingly the vaccinators ought to get together. If they love the truth as zealously as they assert and their methods of investigation are so infallible as to justify the infliction of this abhorred rite upon millions of doubters there ought to be no difficulty in arriving at a common conclusion. It is plain that there is a fallacy somewhere and that its exposing will come not from the friends but from the opponents of vaccination.

John Hunter wrote: "I love to be puzzled, for then I am sure to learn something." If ever there was a vaccinator of that type I have failed to connect with his writing. Our claim is that for the purpose of protection or mitigation one insertion of the virus is as good as any larger number because neither one or many have the slightest value in that direction but that multiple scars have the greater sortative value.

Factors in Sortation.

Age. This is of great moment in accounting for the value of plural scars, especially those of a bad type, and it is in scars of this kind that increase in number is alleged to be the most profitable. It is constantly enjoined by vaccinal authorities to repeat the operation when the resulting scar has been bad but the injunction also says: "Wait till the child gets stronger and healthier, past teething, and the other disturbing influences of early childhood."³ This raises the average age of children with bad plural scars and proportionately diminishes their death-rate.

Apparently, also, very young children are less likely to take at multiple points than their elders. Dr. Jay found the proportion of failures to produce four or more vesicles as the result of seven or eight punctures to be: Under three months, 26.7 per cent. At three months, 18 per cent. Between three months and one year, 8.5 per cent. Above one year there were no failures. The failures are attributed to "a not uncommon deficiency of a due susceptibility to vaccine inoculation observable in weakly and ill-nourished children of delicate mothers, and in others."⁴

Hidden scars. These, as we have seen, play an important part in accounting for the heavy death-rate of the unvaccinated. They are also of great use in supporting the fallacy of multiple scars. The cited testimonies show that in a notable percentage of cases the vaccine scars are completely hidden by the variolous eruption and that in other cases they remain wholly unobscured. Presumably then there are intermediate states of obscurity, where

some of the actually existing scars are visible and some are not. In this way a patient would often be said to have three or two scars, one or no scar, according to the severity of the disease and the tendency to the confluent and dangerous form.

One English hospital physician frankly states: "In two severe cases I made an attempt to find vaccination scars during the eruptive stage but failed and found subsequently that they were well vaccinated and in two comparatively mild cases I counted in the one, one scar and in the other three but subsequently found they had respectively four and eight." ⁵

According to Dr. Welch, "Many of the patients claimed to have had the virus inserted at numerous points but we have recorded the number of cicatrices which we were able to find and not the number which the patient claimed to possess." ⁶

Confluent vaccinia. Some forty odd years ago a New York expert detailed his method of vaccinating. Except for his advocacy of multiple punctures his practice did not differ materially from that of his contemporaries or from that of present-day vaccinators, but his description was exceptionally minute and relevant to our present inquiry. He recommends the simple "puncture or minute opening to the true skin in six to eight points around and in the area of a circle of about half an inch in diameter; in any shape, however, that the groups may have, the insertions should be from one-sixth to one-quarter of an inch apart." The resulting vesicles were, of course, very neighborly but it appears were not disposed to coalesce in "healthy children," and inferentially were so disposed in unhealthy children. Our author continues in reference to the vesicles: "Their average diameter on the tenth day will be about one-quarter of an inch; they will, therefore, nearly touch each other, or if they should be in juxtaposition, afford mutual support in cases of accidental rupture." Further, we are told: "The crusts from such vesicles which were just in apposition on the tenth day will be somewhat smaller and separated from each other on the twentieth." Dr. Loundes finishes

with an acknowledgment of a natural limitation that bounded his efforts. "I have thus described the vaccine disease as it appears, with slight unimportant modifications, in more than 98 per cent. of the cases on healthy children."⁷ A sarcastic reference by Dr. Gregory shows that the English practice had been similar: "Make from six to ten punctures in a circular form, enclosing a space about the size of a shilling. At each insertion press the point of the lancet firmly against the *lower* surface of the wound. Then the charm is firm and good."⁸

Apparently this method of sortation is still adhered to in Great Britain. Replying to a question by Mr. Barnes in the House of Commons in regard to vaccination in Scotland, Mr. Ure, the proper official, answered, in part: "The board is further informed that it is the case that twelve separate punctures are made in primary vaccination of infants, such punctures being very close together."⁹

Delicate Children. As vaccination is not devoid of danger and as the danger is increased by multiple punctures, it is quite common in delicate children and in those whose brothers and sisters have had bad arms, to limit the operation to one puncture; children unable to stand full protection are protected a little. In subsequent smallpox their high death-rate is attributed to the want of sufficient vaccinal protection, the antecedent weakness or bad family history being ignored. The condition that restricts their vaccination to one puncture, also tends to make the resulting scar a poor one.

Relative Inefficiency of Two Scars.

I have mentioned several ways by which sortation is brought about through the agency of multiple scars. It is impossible to state which of these ways is the most efficient, though I impute the greatest value to confluent vaccinia. I now ask the attention of the reader to the fact that under a certain well-defined condition this method of sortation would be wholly eliminated, and as a consequence, when this condition is present even partially,

there should be a noticeable want of correspondence between the number of scars and the expected mitigation. When two punctures are made, one on each arm, there can be no confluent vaccinia, and it is also possible that when two punctures only are made on one arm, they are more widely separated than when three or more are made, and their confluence is made less frequent and less sortative. If three or more punctures are made there must be at least two on one arm, except in the comparatively rare instances where other parts of the body are used, and so an opportunity for confluence is commonly present. It follows, therefore, that if the alleged mitigation is simply a phenomenon due to sortation then the gain associated with the second scar would be considerably less than that associated with the third or fourth scar, if in a large number of cases in the two-scar class the operators had placed one on each arm; but if this practice was infrequently resorted to then the second scar would apparently have greater sortative value than additional ones, though this cannot be positively affirmed. The Royal Commission, discussing the assumed great saving of life by the means of plural punctures, states, "that whilst the distinction in this respect between those with one and those with two marks is not very great, there is a very marked contrast between those with four or even three marks as compared with those with either one or two."

The Commission illustrates this fact in a table which it constructs from the reports from several localities containing in all 4,754 cases, as follows: ¹⁰

TABLE XXIII.

1 Mark	828 cases with 63 deaths or 7.6 per cent.
2 Marks	1,322 cases with 93 deaths or 7.0 per cent.
3 Marks	1,479 cases with 63 deaths or 4.2 per cent.
4 Marks	1,125 cases with 28 deaths or 2.4 per cent.

Following custom the Commission rested after submitting the puzzle, leaving the solution to the opponents of vaccination, perhaps recognizing their greater competency.

Number in Good Scars Unimportant.

A very notable English committee reports: "For the period of life (0-20 years) under investigation a single foveated scar appears indeed as protective as multiple unfoveated scars but multiple foveated scars do not appear to possess the protective advantage over single foveated scars that multiple unfoveated scars have over single unfoveated scars. This indication, namely, of no great difference of protective value between one and many scars in 'good' vaccinations is a somewhat surprising one; and we have hesitated in accepting it as valid until some other data that had been furnished us and which seemed to promise light on the subject had been duly examined." "The committee were compelled to bow to facts. They had no explanation to offer; it was simply surprising. Inured to vaccinal fog it was a matter of no moment if it had shut down a little closer. As foveation and multiple scars indicate the same bodily condition, the discrete diathesis, their dual presence does not increase their prognostic value, or as the vaccinators prefer to put it, "the amount of protection."

Confluent Smallpox and Confluent Herpes.

If vaccinal coalescence is commonly the result of diathesis, as is here maintained, then we might expect that confluence in any skin eruption would be of bad, and discreteness of good, import in smallpox. The following remarks show that there were observers when smallpox was frequent, who thought a prognosis in inoculated smallpox, could be made from the presence or absence of confluence in a surrounding herpetic eruption.

"If we find a cluster of very small blisters which only run together from their vicinity, but are perfectly distinct at the edges where they are more distant from each other, we may depend upon it that the case will prove favorable, and though the patient may have suffered considerably during the symptomatic fever, yet that he will have no subsequent fever, nor probably pustules, and also that the arm will heal without any trouble." "

Scar Area.

Another comparatively recent argument in favor of vaccination is based on studies of scar areas. For instance, in the London Hospital in the epidemic of 1900-2 the patients whose vaccine scars aggregated, individually, one-half square inch or upwards in area were 5,163 in number. The deaths were 379, giving a fatality of 7.3 per cent. Patients with a scar area of one-third of an inch were in number 835. The deaths were 131, or a fatality of 15.6. Those with less than one-third of an inch were 680 in number; the deaths 133 and the percentage 19.5. This is simply the multiple scar argument stated in terms of size instead of number. Presumably patients with the greater number of scars would have the larger scar area. Had these studies shown that one large scar was apparently more effective than one small scar our knowledge would have been advanced somewhat, but large scars are of bad repute.

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CHAPTER XI.

ADDENDA.

Vaccination as an Ethical Question.

"Who lists may in their mumming see
Traces of ancient mystery."

To make a man immune to a disease is to make him immune to a disease producing or insanitary condition. If this can be done by some salable method involving no feature of individual merit, or of injury commensurate with the gain, then we must infer that the power that attached a disease to a certain act or condition has been outwitted, or that disease is a mere stimular to medical inquiry or bacteriological research and has no guiding or inhibitory import whatever. We cannot permanently divide diseases into two classes; divine thou shalt nots, and heavenly conundrums. All must have the same general meaning. If there is in nature some harmless substance a dose of which will enable us to disregard one insanitary condition, then it is fair to infer that there are similar discoverable substances by which we may be enabled to disregard all sanitary law and indeed all natural law that affects conduct, and that ultimately the medical profession will usher in a paradisiacal do-as-you-please in the domain of dirt and vice. That a portion of the profession expects this is shown by the favor and credence with which it receives the perennial announcements of alleged savants that they have discovered or are on the brink of discovering harmless and salable substances that will enable a person to live unharmed in the environments that ordinarily cause smallpox, diphtheria, measles, scarlet fever, yellow fever, typhoid fever, venereal disease, consumption, etc.

But, says one, is it not true that some diseases are, to some extent at least, non-recurrent and if so is it not evident that God or nature intends that in some cases certainly, the bodily changes wrought by an attack of a disease shall confer upon a person the

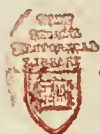
power to do with impunity acts that prior to the attack would have resulted in disease. Yes, that is true. Immunization is a very commonplace fact and it can be induced sometimes to the benefit of the individual but its natural limitations are persistently ignored.

The issue raised here is simply as to the physiological cost. Cheap or harmless immunization is Tetzelian medicine, a rehabilitation of the doctrine of the salable indulgence applied to physical sin. The devil exorcised by Luther and others grinned and found a larger and more up-to-date habitat in the propaganda of an allied cult. The anti-vaccination or more properly the anti-immunization movement is an evolutionary continuation of the movement which we know as the Reformation.

Vaccine immunization is a myth, but if it had a real existence it would still be undesirable save only in a very few exceptionable cases. Actual immunization is always a procrustean process. It is nature's second best arrangement. Nature says: "If you cannot within your physiological limits adapt yourself to your environment I will re-create you on a lower biological scale, provided you are worth making over; otherwise you will go into the scrap heap. In whatever sense and to whatever extent premature death is an extinction of the unfit, in the same sense and to the same extent pathological immunization is a fractional extinction of the fractional unfit, a "propitiary sacrifice to death," carrying a partial compensation paid for with a price ample in amount, unavoidable by any device known to man. Whenever the mechanism of immunization has been traced out it has always been found to be associated with atrophy, hypertrophy, induration, cirrhosis, necrosis, or some other deteriorative change.

The best illustrations of the natural limitations of immunization will be found in cases familiar to all, where the reality of the phenomena is unquestioned and no statistics are required to make them apparent. The blind, the deaf, the hairless and the toothless are immunes. Habituation to the effects of tobacco,

alcohol, arsenic or opium are common forms of immunization. "The horny hand of toil" is a good illustration. The strenuous handling of some weighty implement causes the diseased condition known as congestion. In the lungs the condition is serious, in the hand it is of no vital moment. The organism adapts itself to its new environment by building up a thickened cuticle. This constructive cellular activity with the associated pain, heat, redness and swelling we call the disease. In time, if the irritation continues, an efficient barrier is erected. Congestion no longer ensues but the hand is inferior to the normal hand. The price has been paid and a benefit, such as it is, has been secured. Just in proportion as we are made immune to pain we become incapable of pleasurable sensations. Some similar cost has to be paid for any other kind of immunization. The harmless "protection" is always a fake.



A

Age	78-128
Alcoholics	96
American Civil Experience.....	22
American Immigrants	107
Analysis, Duo-ratio	72
Analysis, Mono-ratio	74
Analysis, Trio-ratio.....	58-65
Anglo-Indian Children	108
Areola, Sortative Value.....	104
Army, American	26
Army, British	33
Army, Confederate	27
Attitude, Professional	53

B

Ballard, Mr., Method.....	43
Ballard, Mr., English Statistics.....	43
Ballard, Mr., Continental Statistics.....	45
Berlin, Statistics	80
Blacks, Fatalities	24-27-62-63-64
Bodily Condition, Importance of.....	94
Boston, Statistics	22
British Army, Statistics.....	33
British Civil Experience, Statistics.....	28-65
British Immigrants	107
British Navy, Statistics.....	29
British Towns	68-81-82

C

Carpi Statistics	14
Ceylon Experience	36
Changes in Character of Good Scar.....	123
Change of Type Theory.....	47-48
Characteristics of Good Scar.....	113
Characteristics of Varioloid.....	88
Charleston Statistics	24
Chester Statistics	51
Chickenpox Theory	49
Children, Anglo-Indian	108
Children, The Very Young.....	12-39
Children, The Sickly	14-39-96-130
Cicatrices. See Scars.	
Civil Experience in Berlin.....	80
Civil Experience, British.....	28-65

Classification, Misleading	120
Collins, Dr., Questions by.....	56
Commission, Royal, on Vaccination.....	31
Confluent, Herpes	132
Confluent, Smallpox	81-86-132
Confluent, Vaccinia	129
Consumption	19
Cupping. See Depression.	
Cutaneous Disorders	96

D

Debauch, Etc.	18
Decadal Immunity	78
Deductions and Predictions.....	1-2-7
Depression in Scars.....	115
Determination of, Errors.....	61
Dewsbury, Statistics	69-70-81
Disease, Course of	101
Disease, Genuine Vaccine	101
Diseases in General	20
Diseases, Vaccinia and Others.....	17
Dog-bite, Scar of.....	113
Dublin, Hospitals	67-69-85
Duo-ratio Analysis	72
Duration of Disease.....	88

E

English Army	33
English Experience	65
English Navy	29
Epidemics	23-25-30-45-63-64-70-133
Errors, Determination of.....	61
European Towns, Statistics	66-72
European Towns, Post-Jennerian	66-72
Examination of Dr. Gayton.....	55
Examination of Dr. Grimshaw.....	56
Examination of Mr. Sweeting.....	54
Experience, English	65
Experience, Dr. Welch's.....	62

F

Fatalities, Pre-Jennerian	22-23-25-34-54-55-56
Fatalities of the Natural Disease.....	22-23-54-55-56-87
Fever, Secondary	89
Fever, Typhoid	85
Fever, Typhus	19
Feldman, Dr. W. M., Theory.....	52
Foveation, Sortative Value.....	113
French Statistics	35

G

Gain and Loss, Confluent Smallpox.....	81
Gain and Loss, Fatalities.....	82-83
Gayton, Dr., Testimony.....	55
Genuine Disease	101
Genuine and Spurious Vaccinia.....	94
German Immigrants	76
German Statistics	34
Gloucester, Statistics	69-70
Graded Protection	107
Gregory, Dr., Method.....	41
Gregory, Dr., Revised Opinion.....	41
Grimshaw, Dr., Testimony.....	56

H

Health and Smallpox.....	95
Health and Vaccinia.....	95
Herpes Affects Vaccinia.....	132
Hidden Scars	15-39-128
Hopkirk, Dr. Testimony.....	73
Hospital Fatalities, American.....	22

I

Immigrants, English and American.....	107
Immigrants, Irish	76
Immunity, Decadal	78
Importance of Bodily Condition.....	94
Increase of Poor Scars.....	122
Infants Omitted Theory.....	50
Inflammation Defined	98
Inflammation, Products of.....	98
Inflammation, Sortative Value of.....	98
Inoculation Scar	116
Inquiry, Method of.....	65
Insusceptibles	16
Intemperance	96
Irish Hospitals	67
Issue, The	2
Italy, Statistics	14

J

Jurin, Statistics	51
-------------------------	----

L

Liechester, Statistics	69-70
London, Statistics	54-66-67-70-73

M

Manchester, Statistics	69
Marson, Mr., Effect of Teachings.....	109
Measles	17
Method, Ballard	43
Method, Gregory	41
Method of Inquiry.....	65
Mexican War Period.....	26-27
Mitigation Theory	5
Mobile, Statistics	63
Mono-ratio Analysis	74
Mulattoes, Fatalities	63

N

Natural Fatality of Smallpox.....	22-23-54-55-56-87
Navy, American	25
Navy, British	29
Negroes. See Blacks.	
New York, Statistics.....	37-74

O

Oakland, Statistics	13
Objections Considered	97
Over 14 Years of Age.....	59
Over 10 Years of age.....	79-81-82

P

Philadelphia, Statistics	76
Philippines	27-91
Pomet, Explanation	6
Plethora	95
Preston, Dr., Testimony.....	31
Problem, The	5
Professional Attitude	53
Protection, Graded	107
Pro-Vaccinal Explanations	46
Provincial Experience Theory.....	52
Prussian Statistics	34

R

Races, The Dark.....	96
Revolt, The	8
Riverside Hospital	37

S

Salvage Ratio, The.....	75
Savory, Mr., Testimony.....	121
Scar, Good, Characteristics of.....	113-123
Scar, Hidden	15-39-128

Scar, Area	133
Scar, Number in Good, Unimportant.....	132
Scar, Relative Inefficiency of Two.....	130
Scar, Simple and Multiple, Vaccine.....	125
Scar, Good Inoculation	116
Scar, Poor, Excess of	117
Scar, Poor, Increase of	122
Scar, Poor, of German Origin.....	118
Secondary Fever	89
Sickly, The	14-39-96-130
Skin, State of.....	96
Smallpox and Health.....	95
Smallpox, Confluent	81-86-132
Smallpox, Distinct	86
Sortation, Factors in.....	128
Sortation Theory	6
Spurious Vaccinia	94
Spurious Vaccinations	106
Statistics, Ballard's Continental	45
Statistics, Ballard's English	43
Statistics, Berlin	80
Statistics, Boston	22
Statistics, British Army	33
Statistics, British Civil	28-65
Statistics, British Navy	29
Statistics, Carpi	14
Statistics, Ceylon	36
Statistics, Charleston	24
Statistics, Chester	51
Statistics, Dewsbury	69-70-81
Statistics, European Towns	66-72
Statistics, France	35
Statistics, Germany	34
Statistics, Gloucester	69-70
Statistics, Italy	14
Statistics, Jurin's, Dr.	51
Statistics, Leicester	69-70
Statistics, London	54-66-67-70-73
Statistics, Manchester	69
Statistics, New York	37-74
Statistics, Oakland	13
Statistics, Philadelphia	76
Statistics, Switzerland	35
Statistics, Summary	71
Statistics, U. S. Army.....	26
Statistics, U. S. Navy.....	25
Statistics, Vaccine.....	125-126
Statistics, Vienna	72-80
Summary Statistics	71
Switzerland Statistics	35

Sweeting, Mr., Examination of.....	54
Syphilis	97

T

Ten Years of Age, Under.....	78-79-80-81-82
Ten Years of Age, Over.....	78-79-81-82
Theory, Chickenpox	49
Theory, Changes in Age Incidence.....	78
Theory, Dr. Feldman's	52
Theory, Infants Omitted	50
Theory, Mitigation	5
Theory, Provincial Experience	52
Theory, Sortation	6
Theory, Change of Type (Cameron).....	48
Theory, Change of Type (Cory).....	47
Tri Ratio Analyses.....	58-65
Typhoid Fever	85
Typhus Fever	19

U

Under Ten Years of Age.....	78-79-80-81-82
Unvaccinated, Who Are the.....	12
Unvaccinated, Fatalities	22-64
U. S. Army.....	26
U. S. Navy.....	25

V

Vaccinia and Other Diseases.....	17
Vaccinia, Course of the Disease.....	101
Vaccinia, Easily Described.....	101-105
Vaccinia, Genuine and Spurious.....	94-101-106
Vaccinia, Confluent	129
Vaccinia and Health.....	95
Vaccine Statistics.....	125-126
Vaccination as an Ethical Question.....	134
Varioloid, Characteristics of.....	88
Varioloid in Armies.....	91
Varioloid and Distinct Smallpox.....	88
Varioloid in Prevaccinal Times.....	85-88
Varioloid in Primitive People.....	90
Varioloid and Allied Topics.....	84
Vaccine Pathology	126
Vaccine Scars	125
Vesicle, The Vaccine.....	102

W

Welch's, Dr., Experience.....	62
-------------------------------	----

Y

Young, The Very.....	12-39
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